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DEVOTED EXCLUSIVELY TO METALLIC SURFACE TREATMENTS

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Routine chemical control of brass plating solutions, giving complete information on reagents required; additional data on faults and corrections in brass plating.

Electrolytic polishing of magnesium and magnesium alloys, including solutions required, current density range, limitations and economics.

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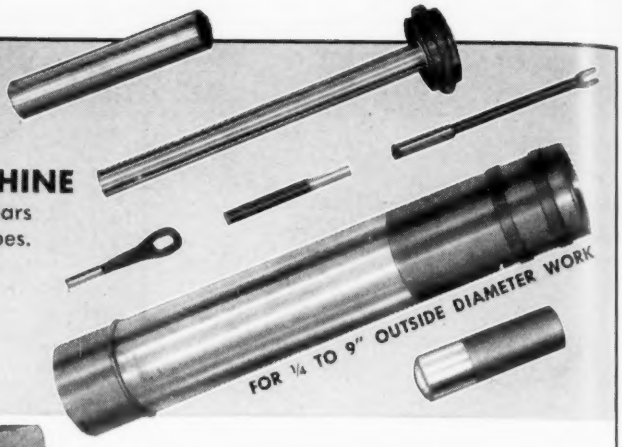

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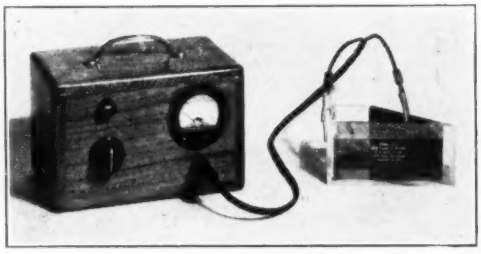

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INDUSTRIAL FINISHING EXPOSITION

In conjunction with the 1947 Annual Convention to be held in Detroit, June 23 to 27, the *American Electroplaters' Society* will conduct an *Industrial Finishing Exposition* for the display of the latest ideas in finishing practice together with the most modern equipment available in the field. All of Detroit's huge Convention Hall has been leased for the occasion.

The Society is issuing a special invitation not only to the representatives of its own industry but to the public at large to come into the Exposition and learn firsthand the importance of this industry, and to discover how many articles in common use depend on electroplating or other finishing techniques for both their appearance and general utility.

Because this is the first opportunity since the war that suppliers and equipment manufacturers have had to display their new products and techniques, it is expected that a full showing will be made by all elements of the industry.

Inasmuch as the Society is managing the Exposition, all proceeds from booth space will go directly into the treasury to be used for the benefit of the entire industry and largely in research and development projects.

Unquestionably, this worthy project will be the most important event in the finishing field in years and deserves the support of everyone connected with the industry. The men of Detroit who are so generously giving of their time and effort to make the Convention and Exhibition a success should get a vote of thanks from all those who are interested in the advancement of the finishing field.

Industrial Finishing Exposition
Detroit Convention Hall

June 23-27, 1947

George L. Nankervis, General Chairman — Herbert Head, Edward Berry, Exhibits Co-Chairmen

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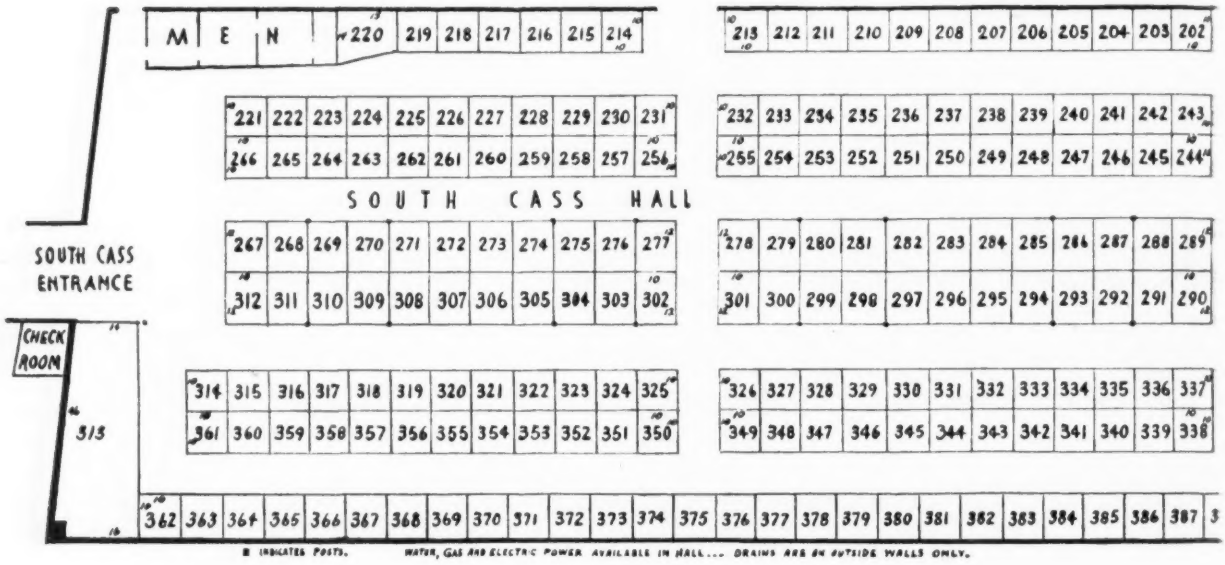

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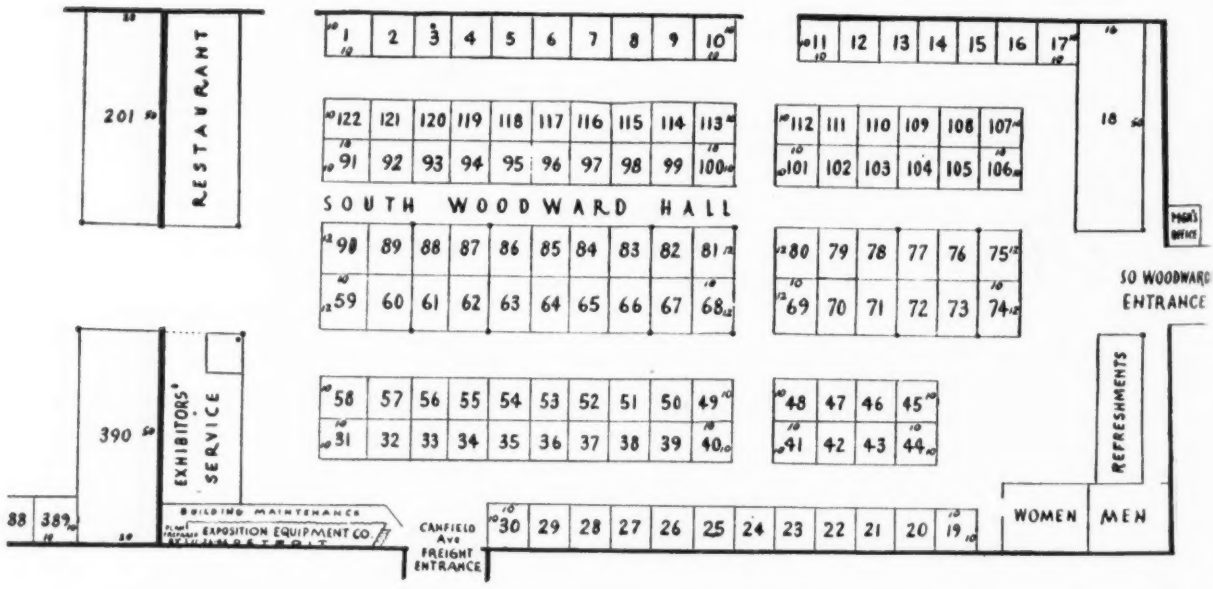

All exhibits will be on one floor as shown above. Space and preferred locations are being allocated as requests are received. For further information write Industrial Finishing Exposition, Convention Hall, 4484 Cass Ave., Detroit 1, Mich.

Electropolishing With Fluosulfonic Acid

By C. B. F. Young, Ph. D.[1] and Kenneth R. Hesse[2]

Introduction

THE purpose of this investigation was to determine whether or not fluosulfonic acid could be used as an electropolishing agent for stainless steels, plain carbon steels and various non-ferrous metals. The systems formed by using fluosulfonic acid in conjunction with the following were investigated: phosphoric, sulfuric, chromic, acetic, and perchloric acids. Other miscellaneous acids and chemicals were also used in individual solutions.

Among the characteristics of the solutions investigated for bright polishing were:

1. Current density limits.
2. Temperature stability of the solutions.
3. Chemical stability of the solutions.
4. Optimum time of polish.

During the war years very little polishing and buffing was called for [35] on electroplated articles because these did not demand eye appeal. However, now that reconversion has come upon us, the demand for polished finishes has again become important. Skilled polishers and buffers are at a premium because many of the men are in the armed services or are no longer interested in this craft. The rates, consequently, are very high, and the amount of polished work produced per manhour has actually dropped slightly. Since polishing accounts for a substantial part of the price of a finished article it is important to use any expedient which will decrease this cost. Electropolishing accomplishes this as no skilled labor is needed, and the time required per article is less.

The advantages of electropolishing over mechanical polishing are:

1. A surface is produced which aids the adherence of electrodeposits.
2. Polishing is accomplished in much less time than by mechanical polishing.
3. Odd shapes can be effectively and economically polished.
4. Articles can be polished cheaper by the electrolytic method.
5. The surface produced is more resistant to oxidation.
6. Electropolishing may be used as a machine or buffing operation.

Among the disadvantages of electropolishing may be mentioned the following:

1. A microscopic undulating surface is produced.
2. A high relief of carbide particles is produced.
3. Non-metallic inclusions on the surface of the metal are severely attacked.

Previous Work

Many patents and papers have been written on the electropolishing of ferrous and non-ferrous metals and alloys. A search of the literature fails to reveal any work using fluosulfonic acid as a bath constituent.

The solutions most closely akin to fluosulfonic acid solutions are those containing hydrofluoric and sulfuric acids or hydrofluoric and chromic acids.[5, 33] The first patents referring to these solutions is by Blaut and Lang and specifies the use of solutions containing concentrated sulfuric and hydrofluoric acids in concentrations of 2 to 20 per cent by volume. A current density of over 300 amps./sq.ft. (985 amps./sq.ft.) was required to polish chrome-nickel and chrome-stainless steels. Other finishes ranging from a white, pearly, satin finish to etched finishes were obtained by varying conditions. Descaling of the above metals was also accomplished.

The second patent referring to the use of hyrofluoric and chromic acids is by Mason and Tosterud.[33] This patent relates to aluminum and aluminum base alloys. Reflecting surfaces are produced on these metals by making them anodic in a bath containing 1 to 25.0 per cent of chromic oxide and 0.2 to 1.5 per cent of hydrofluoric acid. A current density of 46 to 52 amps./sq.ft. (15 to 17 amps./sq.dm.) was used for 10 minutes.

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[2] Graduate Student, Brooklyn Polytechnic Institute, Brooklyn, N.Y.

Most of the solutions devised so far have as their basic components the following acids:

Phosphoric Acid	Hydrofluoric Acid
Sulfuric Acid	Various organic acids
Chromic Acid	such as citric, lactic
Perchloric Acid	and acetic.

All of these acids are used in concentrated solutions. Dilute solutions have never been observed and are improbable theoretically because of the difficulty of forming viscous films by their use.

A resume of solutions that have been used for the electropolishing of plain carbon steels and stainless steels along with operating data, is shown in Table I.

From this, it is apparent that there are a great many solutions and operating conditions which can successfully polish steel and stainless steel. Other solutions can be found in the literature, references 1, 3, 4, 6, 8, 9, 11, 12, 18, 19, 24, 34, 35 and 48.

There are a number of papers which give solutions and conditions for electropolishing non-ferrous metals and alloys, references 2, 4, 8, 18, 21, 22, 34 and 48. Table II gives some of the latest developments in this category.

Theory

The first theory of electropolishing was formulated by Jacquet to explain the results obtained when certain metals and alloys were made the anode in an acetic anhydride-perchloric acid bath. He reasoned that a viscous film of dissolved salts existed around the anode due to the solution of the metal by the bath.[46] This layer formed over the surface in such a way that it covered all the hills and valleys of the surface. Thus the solution interface could be considered a straight line. In this way there would be more depth of film over a valley than over a hill. Consequently, the resistance would be greater in the former because of the greater distance the current had to flow between anode and cathode. This decreased the current flowing into the depressions in relation to the current flowing to the elevations. Thus the hills are dissolved to a greater extent than the depressions.

Elmore, however,[15] modified and broadened this simple explanation. He stated that the anode film served two functions. First, it was the source of a back electromotive force in the bath. Secondly, the film served to limit the current through

TABLE I

METAL	SOLUTION	CUR. DEN. Amps/Sq.Ft.	TIME (Min.)	TEMP. °C.	REF.
1. Low carbon steels	H_2SO_4 (40%) H_3PO_4 (46%) Dextrose (4%) Water (15%)	210-650	5-10	28-40	29
2. Low carbon steels	H_2SO_4 (15%) H_3PO_4 (65%) CrO_3 (5%) Water (15%)	430-1000	3-5	42-55	29
3. Nickel-chrome, chrome steels, nickel monel, and nickel silver	H_2SO_4 (40%) HF (10%) Water (50%)	over 250	½-4	....	5
4. Stainless steels	H_2SO_4 (10-30%) Citric Acid (30-70%) Water	72-220	....	82-88	23
5. Carbon steels (less than 0.5%C)	$HClO_4$ (sp.gr. 1.12) 1 part Ethyl alcohol 4 parts	290-570	....	Above 35	10
6. Carbon steel (greater than 0.5%C)	$HClO_4$ (sp.gr. 1.12) 1 part Ethyl alcohol 4 parts	570-720	....	Above 35	10
7. Stainless steel, rustless iron, nickel and alloys	H_2SO_4 (25%) H_3PO_4 (69%) Water (6%)	Above 50	5-90	60	17
8. Stainless iron and steel	$HClO_4$ (75%) Water (25%)	280-570	....	10-30	5
9. Chrome-nickel steels	H_2SO_4 (60-90%) Water	860-1700	....	30-57	7
10. Mild steel	Lactic acid (15-40%) H_2SO_4 (5-30%) H_3PO_4 (35-60%) Water (2-20%)	15-100	60-120	Room Temp.	41
11. Stainless steel	Lactic acid (15-40%) H_2SO_4 (5-30%) H_3PO_4 (35-60%) Water (2-20%)	72-290	1-20	70-93	41

The acid concentrations refer to concentrated solutions: H_2SO_4-96%, H_3PO_4-85%, HF-35%, $HClO_4$-sp.gr. 1.12.

TABLE II

METAL	SOLUTION	CUR. DEN. Amps/Sq.Ft.	TIME (Min.)	TEMP. °C.	REF.
1. Aluminum	HF (2-50%) Glycerol (5-75%) Water (10%)	50-450	....	....	40
2. Nickel silver, nickel, iron and their alloys	H_2SO_4 (33-50%) Glycerol (33-40%) Water (remainder)	....	....	....	18
3. Nickel	H_2SO_4 (sp.gr. 1.64) Small amounts of either glycerol, benzene, or toluene sulfonates to prevent streaks.	250	½-2½	30	26
4. Copper	H_3AsO_4 (84%) CrO_3 (10%) Water (6%)	385	15	55	17
5. Zinc and zinc-copper alloys	H_3AsO_4 (84%) CrO_3 (10%) Water (6%)	340	8	63	17
6. Brass	H_3AsO_4 (15%) H_3PO_4 (55%) CrO_3 (3%) Water (27%)	500	30	....	17
7. Cadmium	KCN (10.5%) Cd $(OH)_2$ (1.75%) Water (remainder)	36.5-45.8	15	....	30
8. Tin	$HClO_4$ (20%) Acetic anhydride (80%)	86-140	8-10	29	28
9. Tungsten	NaOH (10%) Water (90%)	29-57	20-30	20	26

the bath when the back electromotive force had reached a certain value dependent upon conditions in the cell. The anode film is formed because of the slow rate of diffusion of metal ions at the anode surface. The film must be dissipated by diffusion and not by electrolytic motion of the metal ions, because the larger part, by far, of the current through the cell is carried by hydrogen ions.

When the concentration of metal ions in the film has reached the solubility limits of that metal in the solution, the current will then be limited by the rate of diffusion of metal ions away from the anode.

Electropolishing baths can be classified in a number of ways. For instance, they may be classified according to the voltage drop that is impressed across the cell.[47] Most cells using the mineral acids can be used at low-cell voltages from ½ to 20 volts while others, employing organic acids and compounds are operated at higher voltage, namely, 50 to 100 volts.

Another way of classifying these baths is by their operating life.[20] Under this classification, the baths fall into two groups: those with a long operating life where the metal ions plate out on the cathode as fast as they are produced in the anode area, and those that have a finite operating life and are discarded when the metal concentration reaches four to five per cent. A good example is the chromic acid baths, or the baths which produce chromic acid when the work is placed into them and the current allowed to flow.

Electron interference pattern researches on the electropolishing of single crystal and polycrystalline materials of aluminum, zinc, iron, copper, and lead, using acetic anhydride and perchloric acid electrolytes shows that the material is removed preferentially from the high points leaving a plane surface which is not deformed.[29] If the current is allowed to remain on longer than is necessary for complete polishing the surface becomes rough again. Most of the other commercial solutions, however, can be used for longer than the required time to obtain a polish and a roughened surface is not obtained. This is the basis of the electro-machining operations that have been used commercially.[20]

Materials and Apparatus

The electrical circuit used in the experiments was very simple and is shown in Figure I. The current through the electrolytic cell was regulated by the lamp bank in series with the cell. By varying the number of lamps or heaters in parallel in the bank a fairly smooth range of currents were available. Voltage and current values were obtained using standard instruments.

No provision was made for maintaining the solution temperature during the time the cell was operated but temperature readings were taken before and after the sample was polished. Although, in this case, isothermal conditions were not obtained, this lack of control did serve to show the thermal stability of the solution. Also the effect of a rise in temperature upon the polishing was obtained.

The cathode, in all cases, was a one-half inch diameter carbon rod about six inches long, while the anode was cut from the stock to be polished in 1" x 2" sheets. The metals used as anodes were: 18-10 stainless steel, nickel and nickel silver, low carbon steels, high carbon steel, and copper alloys.

Visual examination of the metal surface was used to determine the degree of polish attained. It was thought that this was sufficient in view of the fact that the investigation concerned itself primarily with a determination of possible polishing baths and not with a quantitive appraisal of various solutions.

Fabrication data on the metals used as anodes:

18-10 Stainless Steel, cold rolled and annealed, 18-20% Cr, 8-10% Ni, 0.08% C, 2% Mn.

S.A.E. 1020 coarse firain, hot rolled steel, 0.23% C, 0.44% Mn, 0.034% S, 0.077% Si.

S.A.E. 1070 fine grain, hot rolled steel, 0.75% C, 0.94% Mn, 0.010% P, 0.026% S, 0.21% Si.

Low carbon rimmed type steel, cold reduced and box annealed, 64.2% Cu, 17.1% Zn, 0.010% Pb, 0.07% Fe, 18.3% Ni.

Muntz Metal, cold rolled and annealed, 61.0% Cu, 38.94% Zn, 0.025% Pb, 0.02% Sn, 0.01% Fe.

70-30 brass, cold rolled and annealed, 69.98% Cu, 30.0% Zn, 0.005% Pb, 0.01% Fe.

Beryllium Copper, cold rolled and solution heat treated, 97.3% Cu, 0.09% Fe, 0.28% Ni, 2.23% Be.

Nickel, standard, cold rolled, soft.

Acid Concentrations:

HSO_3F	Fluosulfonic Acid	96% pure (4% H_2SO_4)
H_3PO_4	Phosphoric Acid	85% "
H_2SO_4	Sulfuric Acid	97% "
$HClO_4$	Perchloric Acid	70% "
HF	Hydrofluoric Acid	40% "

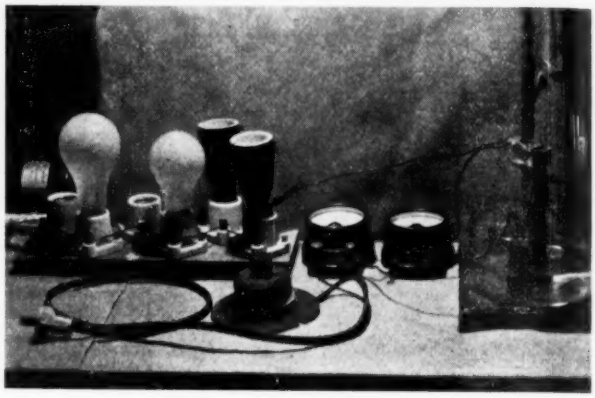

Figure 1. Apparatus setup.

Observed Data

The following tables list all the experiments performed in an effort to determine suitable concentrations and components of fluosulfonic acid and other chemicals which would produce polishing.

(To be concluded in March)

TABLE III
ANODE—18-10 STAINLESS STEEL

RUN NO.	HSO_3F (cc)	H_3PO_4 (85%) (cc)	H_2O (cc)	CUR. DEN. Amps/Sq.Ft.	VOLTAGE	TIME (Min.)	TEMP. °C.	REMARKS
1.	10	90	0	140-860	15-16	2-5	30-70	Good polish
2.	20	80	0	Below 860	17-23	2	30-60	Good polish
3.	30	70	0	860-1400	17-19	2-3	30-60	Good polish
4.	40	60	0	Very high	....	..	....	Much fumes
5.	50	50	0	Very high	....	..	....	Excessive fuming
6.	10	80	10	360-1580	9-17	1-10	30-60	Fairly good polish
7.	10	70	20	570-1580	6-14	1-3	30-60	Fairly good polish
8.	10	60	30	430-1150	5-12	1-3	30-60	Good polish
9.	10	50	40	....	....	..	....	No good
10.	20	70	10	650-1300	4-11	1-3	40-60	Fair polish
11.	20	60	20	430-1150	8-11	1-5	30-60	Fair polish
12.	20	50	30	215-1150	4-11	1-5	20-60	Fair polish
13.	20	40	40	790-1580	6-9	1-2	40-50	Fair polish
14.	20	30	50	Below 2880	8	1	30-40	Bad polish
15.	30	60	10	....	....	..	....	No good

TABLE IV
ANODE—LOW CARBON STEEL

RUN NO.	HSO_3F (cc)	H_3PO_4 (85%) (cc)	H_2O (cc)	CUR. DEN. Amps/Sq.Ft.	VOLTAGE	TIME (Min.)	TEMP. °C.	REMARKS
1.	10	90	0	140-1080	20-40	5-16	20-88	Fairly good polish
2.	20	80	0	2160	20-40	3	26-78	Not too good
3.	30	70	0	Very high	....	..	....	Bad polish
4.	5	95	0	245-1070	20-40	3-15	21-77	Polished good
5.	0	100	0	1100-2300	27	3-5	20-82	No good

TABLE V
ANODE—18-10 STAINLESS STEEL

RUN NO.	HSO_3F (cc)	CrO_3 (g)	H_3PO_4 (85%) cc	H_2O (cc)	CUR. DEN. Amps/Sq.Ft.	VOLTAGE	TIME Min.	TEMP. °C.	REMARKS
1.	5	10	75	20	187-1220	3-5	1-15	30-80	Good polish
2.	10	5	80	10	728-1080	15-17	1	30-70	Good polish
3.	10	10	70	20	216-1150	6-12	2-15	30-60	Good polish
4.	10	10	60	30	216-430	2-6	3-9	30-70	Fair polish, solution life short
5.	10	30	50	40	127-720	3-7	2-10	20-45	Not too good
6.	10	5	70	20	158-1340	2-13	1-10	20-70	Fairly good polish
7.	10	2	70	20	122-1240	5-12	1-10	25-72	Fairly good polish
8.	20	2	60	20	158-930	4-12	1-20	30-60	Fairly good polish, solution unstable
9.	20	10	60	20	230-720	2-9	2-5	30-60	Fair polish
10.	25	5	70	5	1150	17	1	45	Fair polish, solution unstable

TABLE VI
ANODE—NICKEL SILVER

RUN NO.	HSO_3F (cc)	H_3PO_4 (85%) (cc)	CrO_3 (g)	H_2O (cc)	CUR. DEN. Amps/Sq.Ft.	VOLTAGE	TIME Min.	TEMP. °C.	REMARKS
1.	10	70	2	20	245-2300	3-15	2-5	25-66	Good polish
2.	10	60	2	30	245-1150	5-21	1-3	23-63	No good
3.	10	90	1-2	0	288-860	10-21	3-4	30-70	Good polish
4.	10	70	20	20	288-570	3-15	2-4	38-60	Bad polish
5.	10	80	10	0	245-450	7-13	1-10	40-70	Fair polish
6.	10	70	10	20	115-790	3-12	2-5	30-60	Good polish
7.	25	70	5	5	430-800	36-38	1	48-58	No good
8.	20	60	10	20	230	3	2	28	No good

TABLE VII
ANODE—18-10 STAINLESS STEEL

RUN NO	HSO_3F (cc)	H_2SO_4 (cc)	H_3PO_4 (85%) (cc)	H_2O (cc)	CUR. DEN. (Amps/Sq.Ft.)	VOLTAGE	TIME Min.	TEMP. °C.	REMARKS
1.	10	90	0	0	107-505	40-50	1-3	25-50	No good
2.	10	30	60	0	Below 1150	16	1	60	Good polish**
3.	10	20	70	0	Below 1150	22	1	30-50	Good polish**
4.	20	20	60	0	Below 1150	20	5	70	Fair polish
5.	20	30	50	0	Below 2150	20	1	50-60	Fair polish**
6.	20	40	40	0	112-550	23-29	1-3	25-50	No good
7.	10	20	40	20	1200	10	1	79	Good polish
8.	10	10	40	30	390-1990	5-11	1-3	20-60	Fair polish**

** Indicates that the solution works just as well, if not better, when the fluosulfonic acid is left out.

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(*Continued on page* 81)

Periodic Reverse-Current Electroplating

By George W. Jernstedt, *Manager Electroplating Projects, Westinghouse Electric Corp., East Pittsburgh, Penna.*

A process of electroplating has been devised by which polishing costs are reduced markedly while at the same time the plated deposit shows superior qualities of strength, elasticity, density, and freedom from flaws such as porosity. The author explains a novel, periodic reverse-current plating cycle in which plating current is reversed briefly at short periodic intervals to deplate unsound and inferior metal deposited in the previous plating period and which builds up many microscopically thin increments of sound metal to make a deposit more dense and of greater homogeneity than that possible with conventional continuous-current methods.

WITH periodic reverse-current[1] it is possible to produce a plate that is considerably smoother than the surface of the base member to which it is applied. For example, 0.0015 inches of copper have been periodic reverse-current plated on shot blasted steel without any evidence of the roughened finish being apparent at the surface of the copper plate. Burned electro-deposits, nodules, exaggerated buildup of metal at corners or at sharp points, and burrs can be reduced or eliminated as shown in Fig. 1, when the new process is used.

Periodic Reverse-Current Process

For most applications, the periodic reverse-current[1] process consists of a cycle in which the plating current is applied for a period of from two to forty seconds to deposit a microscopic increment of metal, then the current is reversed for a period of from one-half to five seconds to remove a portion of the previously plated increment. (See Fig. 2.) This reverse-current period is sufficient to remove the unsound and inferior metal that has been plated during the time the work was cathodic. Repetition of the cycle builds up the plate thickness wanted. Reversal of the current deplates from 10 to 50 per cent or more of each increment just plated. The amount to be deplated per cycle is regulated in accordance with the quality of the increment and the desired quality of overall deposit.

There are several methods by which the reverse-current process can be carried out. The most obvious method is to reverse the current at the tank. This can

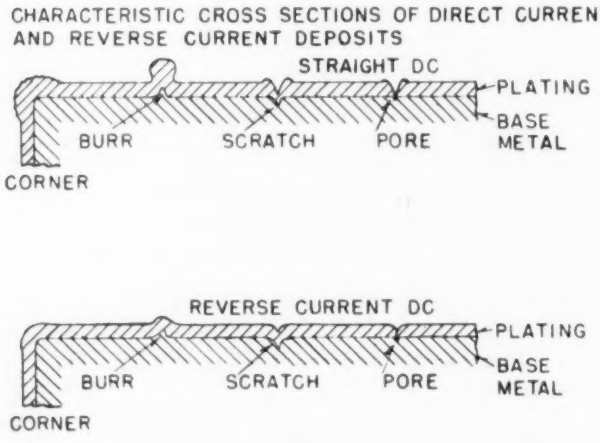


Fig. 1. Characteristic cross sections of direct-current and Perodic Reverse-Current deposits.

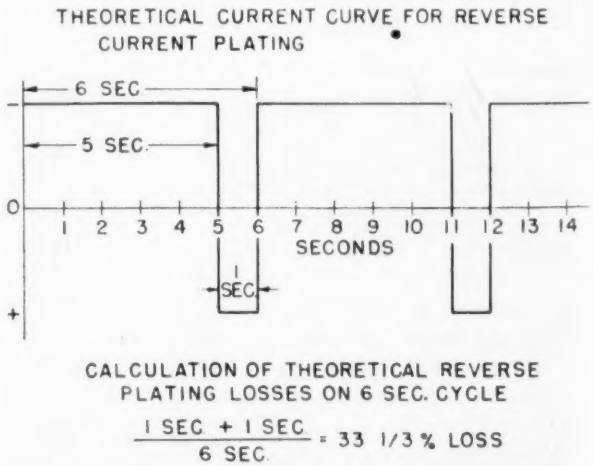

THEORETICAL CURRENT CURVE FOR REVERSE CURRENT PLATING
6 SEC
5 SEC
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14
SECONDS
1 SEC
+
CALCULATION OF THEORETICAL REVERSE PLATING LOSSES ON 6 SEC. CYCLE
1 SEC + 1 SEC / 6 SEC = 33 1/3 % LOSS

Fig. 2. Theoretical current curve for Periodic Reverse-Current Plating.

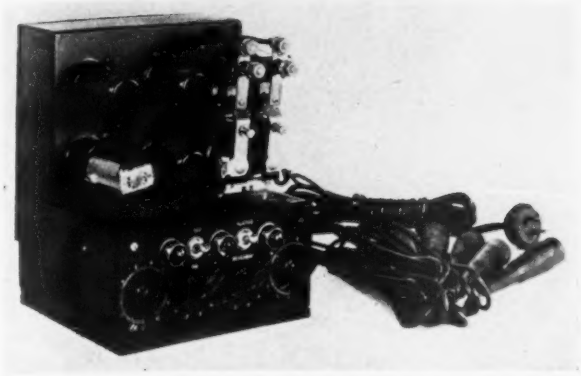


Fig. 3. Electronic timer and relay for experimental Periodic Reverse-Current Plating.

be accomplished by means of low voltage contactors plus a timing device, as shown in Fig. 3. Another method is to reverse the field current in the generator. This can be done by means of a timer similar to the one employed in the low-voltage reversing method operating relays of suitable size to carry the generator field current. There are merits in each method. There are still certain problems that arise in the operation of a generator when its field is reversed as rapidly as is required.

Certain definite and valuable results are secured by such reverse-current deplating. Unsound and inferior metal is removed preferentially to produce flat, level surfaces. The surface of the increment is smoothed progressively with each succeeding increment. The metal surface is brightened by the current reversal and hand buffing or polishing, therefore, can be cut down or eliminated. Due to the sounder metal and smooth surface produced by current reversal, succeeding increments actually adhere more tightly. Almost any thickness plate, for example one-quarter inch thick, can be produced without surface flaws. Furthermore, the

Fig. 4. (A) High-speed du-Pont copper solution direct-current rack-plated magnet. 0.15 inches average, 60 A.S.F., 5 hours bath filtered and agitated. (B) High-speed duPont copper solution, barrel plated. 0.015 inches average, 7 hours plating time. (C) High-speed duPont copper solution. Periodic Reverse-Current Plated. 0.012 inches average, 4 hours bath filtered and agitated. All magnets received approximately 30 grams of copper.

speed of plating can be increased in producing heavy electrodeposits without sacrifice of quality.

In electroplating a base metal using any given solution of electrolyte, the limit on the current density that can be employed to deposit metal is reached when the electrolyte immediately adjacent to the base member becomes so depleted in metal ions that further increases in current density do not produce proportional increases in deposited metal. Thereafter, a certain amount of the water in the electrolyte begins to decompose, and hydrogen is formed on the surface

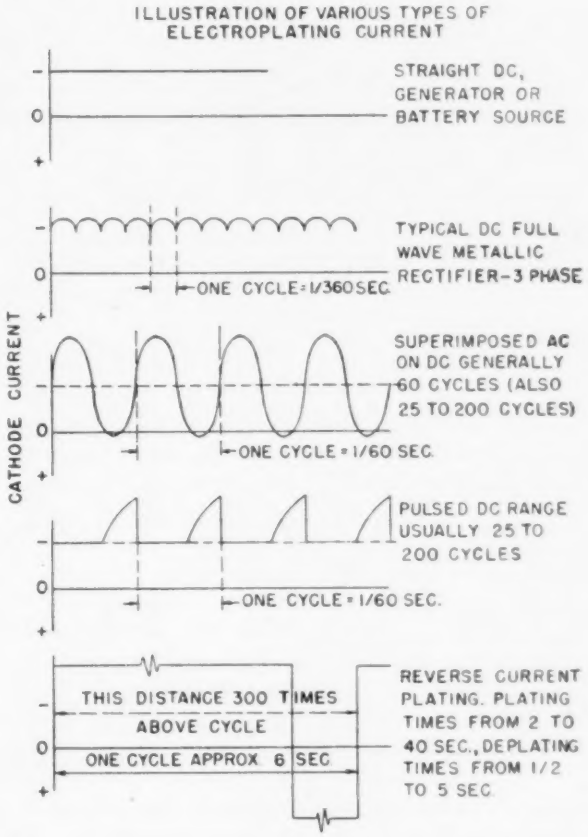


ILLUSTRATION OF VARIOUS TYPES OF ELECTROPLATING CURRENT
CATHODE CURRENT
STRAIGHT DC, GENERATOR OR BATTERY SOURCE
TYPICAL DC FULL WAVE METALLIC RECTIFIER-3 PHASE
ONE CYCLE=1/360SEC.
SUPERIMPOSED AC ON DC GENERALLY 60 CYCLES (ALSO 25 TO 200 CYCLES)
ONE CYCLE = 1/60 SEC.
PULSED DC RANGE USUALLY 25 TO 200 CYCLES
ONE CYCLE = 1/60 SEC.
THIS DISTANCE 300 TIMES
ABOVE CYCLE
ONE CYCLE APPROX 6 SEC.
REVERSE CURRENT PLATING. PLATING TIMES FROM 2 TO 40 SEC., DEPLATING TIMES FROM 1/2 TO 5 SEC.

Fig. 5. Illustration of various types of electroplating current.

of the base member, thus reducing the plating efficiency. This hydrogen tends to blanket the surface of the base member and thereby greatly diminishes the rate of metal deposition. This phenomenon is known as polarization. Plating is ordinarily conducted at such a rate as to prevent or minimize polarization. By use of periodic reverse-current electroplating, enough ions are established adjacent to the base metal during periods of reverse current so that the effects of polarization are made negligible even with overall speeds of plating increased manyfold over that possible with continuous direct current.

It would appear that due to the reverse- or deplating-current portion of the cycle, the overall efficiency would be greatly reduced as compared to continuous direct-current plating. For example, if a cycle of five second plating-time current and one-second reverse-current totaling six seconds were employed, it might be assumed that the net metal deposited would amount

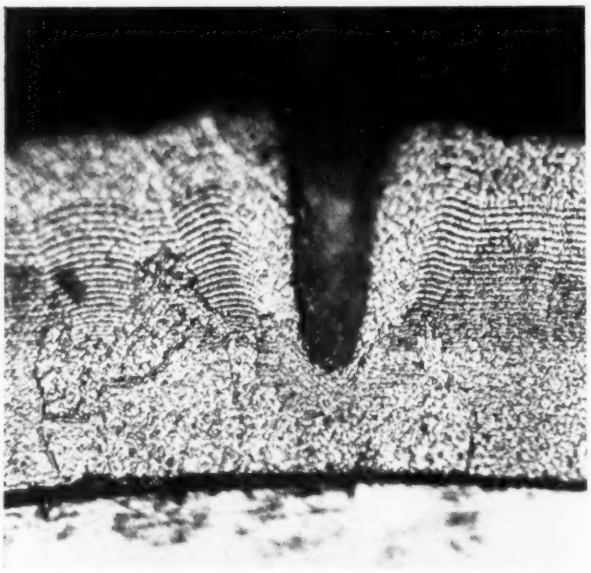


Fig. 6. Photomicrograph of direct-current high-speed copper-plated steel. 80 A.S.F., 45 minutes, 0.006 inches by 500.

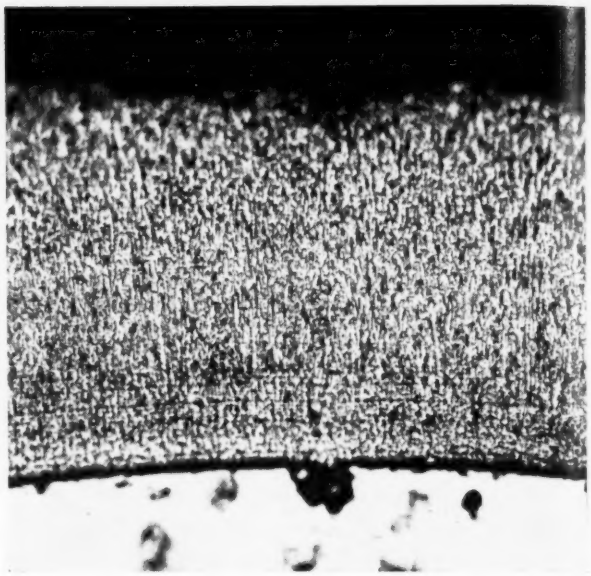


Fig. 7. Photomicrograph of Periodic Reverse-Current high-speed copper-plated steel. 120 A.S.F., (90 A.S.F. effective) 35 minutes, 0.006 inches by 500.

to that applied in four seconds plating time using continuous direct current, so that the same current density with the latter would produce an equal deposit in 66⅔ percent of the time. A number of compensating factors reduce this apparent time less. The plating part of the cycle in many solutions appears to operate at 100 percent efficiency as compared to direct-current plating processes where the efficiency is normally 80 percent or lower. Reduction in polarization when the new process is used expedites the plating part of the cycle so that the subsequent plating efficiency is improved. The main reason for the speed of periodic reverse-current plating is that the plating portion of the cycle can be carried out at greater current densities than with conventional plating systems.

The quality of plating done by the new process even at high speeds is usually better than the best continuous direct-current plating. As an example, previously .016 inches of copper has been deposited on meter magnets in from seven to ten hours, using potassium copper cyanide barrel plating, in what was considered fast plating. Using rack plating, this time was cut to some five hours, but the plate was so nodular that it was pebbly in appearance. With reverse-current, a deposit was produced superior in smoothness and density in less than four hours, and several times the job was done in three and one-half hours (see Fig. 4).

Comparison with Other Methods

A schematic comparison of various methods of current modifications is shown in Fig. 5.

The first curve represents direct current as secured from a battery or a generator.

The second curve indicates the wave pattern that might be expected from a three-phase, full-wave, metallic rectifier. The results from this type of current source in comparison with the generator source are, for all practical purposes, identical.

In the case of the third curve, a d-c source, either rectified or generated, is applied and then a 60-cycle, a-c potential is superimposed on the d-c circuit. By this means, it is intended to increase the allowable current density and thereby expedite the plating.

The fourth curve indicates a somewhat similar condition. However, the negative portion of the a-c cycle is eliminated, and the result is a pulsed, direct current of the same frequency as the a-c current. The additional benefit advanced for this process is that the total coulombs passed in any given time can be increased appreciably by this pulsing procedure and, consequently, a faster plating rate obtained.

The theoretical periodic reverse-current plating cycle is shown in the last curve. It is evident that the reverse period is of an appreciable length of time in comparison with any of the previously indicated current procedures. In most cases, the length of the overall cycle is over 300 times that employed in the other procedures. The actual number of coulombs employed in the reverse period is often sufficient to effect deplating of from 30 to 40 percent of the metal deposited in the plating, or first part of the cycle. As is the case with any process, best results are obtained only when the process is properly applied. The new method can be controlled accurately to emphasize any of its benefits, depending upon the proposed application.

Electrolytes

As might be expected, reverse-current plating works much better with some electrolytes than others. In several cases no improvement has been detected in reverse-current plating as compared to conventional continuous direct current. However, a definite and substantial improvement is evident in most acid and

alkaline electrolytes by the new process. In the cyanide baths, results with reverse-current plating are outstanding. Smoother, brighter and more corrosion-resistant coatings are produced in almost every case. The newly developed process is especially adaptable for depositing thick, dense coatings of copper from a cyanide bath. For example, it is possible to electroform parts in a cyanide solution, thus avoiding the limitations of the acid copper process, such as poor throwing power and double the power requirement. Greater plating speeds and higher quality copper are prime features of the method.

Other metals than copper have been tried. From this, it appears that the baths most suited for this process are in general cyanide-type plating baths such as copper, silver, zinc, cadmium, and even gold. Brass works very well and can be made to plate bright directly under certain conditions. However, to employ any of these baths, an investigation to determine the best reverse-current cycle should be made in any given application before any specific commercial plating set-up is recommended.

Brighteners can be left out when the new process is used, though they may help in some cases. Occasionally the full benefits of periodic reverse-current plating may not be evident at the normal operating conditions of the bath. By changing such factors as temperature, metal concentration, and pH, even greater improvement can be secured with reverse current.

Quality of Plate

Figs. 6 and 7 are typical examples of the comparative microstructure of metal plated using the two methods. The photomicrograph in Fig. 6 shows a pore in a high-speed copper-plated part. The interesting point in this photograph is the series of dark lines parallel to the base metal. It might be assumed that periodic reverse-current would produce such lines. Actually, the opposite is true. The plating in Fig. 6 was produced by regular continuous direct-current in a high-speed copper-cyanide plating bath, and in Fig. 7, the same bath was used, but the current was reversed periodically (3½ seconds cathode, ¾ second anode). The uniform structure of this latter deposit is quite apparent, and the absence of the dark lines, which are characteristic of many bright plating processes employing direct current is noteworthy.

In another example where bright metal surfaces are normally produced by several polishing and plating operations, the cost of finishing had generally exceeded the cost of plating. A detailed cost analysis of the production of one highly polished part, both by direct-current and periodic reverse-current electroplating is as follows:

	Direct Current	*Periodic Reverse-Current*
Burr and Brush	0.0313	0.0313
Polish Edges	0.0300	.....
Polish Top	0.0093	.....
Spot Polish	0.0093	.....
Copper Plate	.....	0.0300
Copper Polish	.....	0.0600
Nickel Plate	0.0246	0.0200
Nickel Buff	0.0786	.....
Nickel Color Buff	0.0235	0.0235
Chrome Plate	0.0139	0.0139
Chrome Color Buff	0.0246	0.0246
TOTAL PLATING AND FINISHING	0.2451	0.2033
Unplated Part	0.0946	0.0946
TOTAL COST	0.3397	0.2979

By use of the new process, the total cost is reduced from 0.3397 to 0.2979, or a decrease of over 12 percent. Finishing costs that are approximately 25 cents in the direct-current method, decrease to slightly over

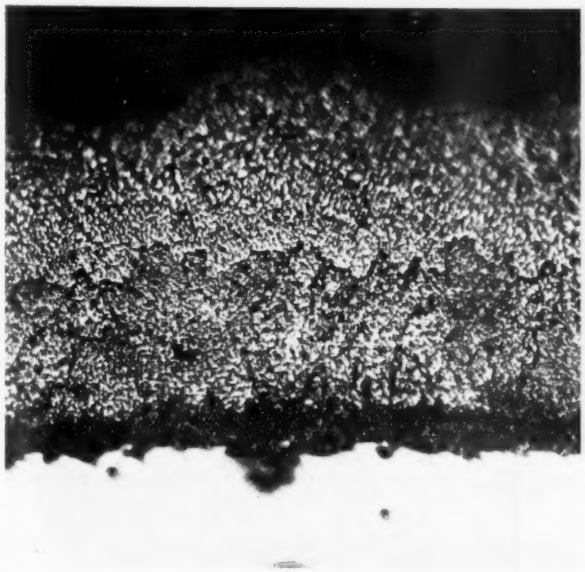


Fig. 8. Direct-current plated, high-speed copper filtered and agitated solution, 80 A.S.F., 0.006 inches, 45 minutes by 500.

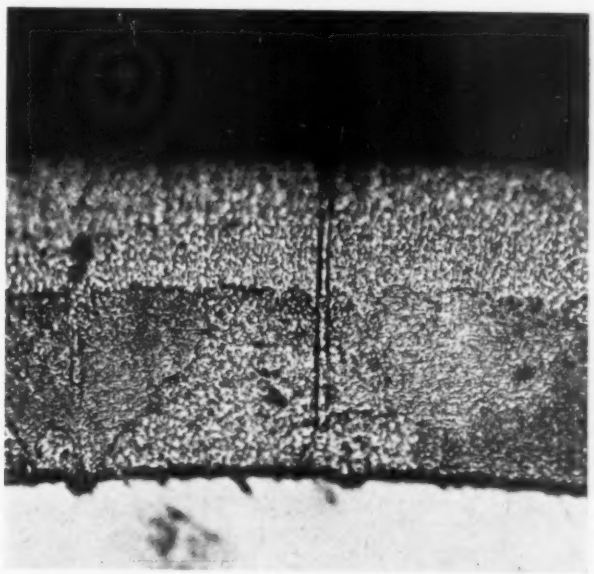


Fig. 9. Direct-current plated, high-speed copper filtered and agitated solution, 80 A.S.F., 0.006 inches, 45 minutes by 500.

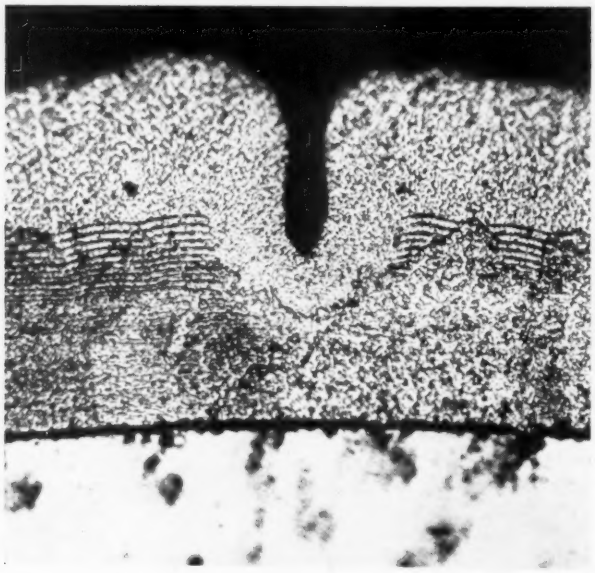


Fig. 10. Direct-current plated, high-speed copper filtered and agitated solution, 80 A.S.F., 0.006 inches, 45 minutes by 500.

20 cents, or a saving of roughly 20 percent, when the reverse-current method is used and the product has better metallurgical characteristics and a finish fully equal to that obtained by the older method. Even better savings are expected in the future when the full advantages of the method are realized. It should be noted that certain polishing procedures were retained when the newer process was used. This is because while a high degree of polish can be achieved through the use of this process, sometimes it is more economical to give a final color buff to achieve the high luster required for certain finishes.

An investigation was made of copper deposits in the order of 0.005 to 0.007 inch in thickness. In normal d-c, high-speed copper plating, even with rapid filtration and agitation, many imperfections are found in the deposit. Figs. 8, 9, and 10 are examples of such copper plating. Fig. 8 shows the result of a microscopic roughness in the base metal. The base metal was apparently bright. The general non-uniform structure of the deposit is apparent. Fig. 9 is a cross section of a pore probably caused by a gas bubble. Fig. 10 is a cross section of a pore probably caused by some foreign material. In all three figures the quality of the copper is in general better near the surface. Using the same solution and procedure except that the current has been rversed periodically, the quality of the copper is improved considerably. Fig. 11 shows a scratch on the base metal which was filled and its effect eliminated after about 0.001 inch of copper was deposited. Fig. 12 shows the general uniform quality of reverse-current plated copper.

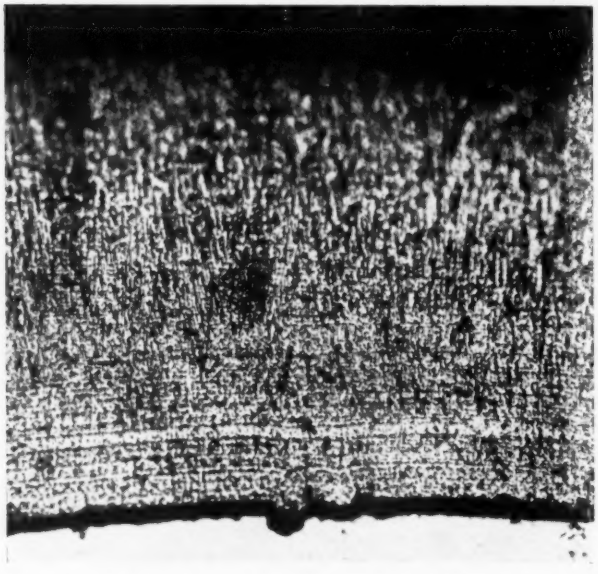


Fig. 11. Periodic Reverse-Current Plated, high-speed copper filtered and agitated solution, 120 A.S.F. (90 A.S.F. effective), 0.007 inches, 40 minutes by 500.

Advantages

While periodic reverse-current plating is not a panacea for all plating ills, it has already proved itself to be an exceptionally worth-while tool in some very large copper-plating establishments in this country. In general, it may be expected to do one or more of the following things:

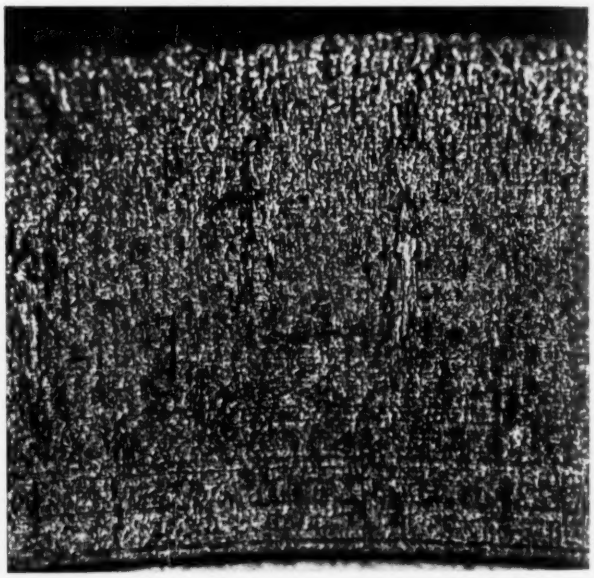


Fig. 12. Periodic Reverse-Current Plated, high-speed copper filtered and agitated solution, 120 A.S.F. (90 A.S.F. effective), 0.007 inches, 40 minutes by 500.

(1) Increase the rate of plating.
(2) Increase the density of the metal deposited.
(3) Improve the brightness of the surface.
(4) Apply plated metal of greater smoothness than the base metal.
(5) Allow heavier deposits.
(6) Decrease porosity.
(7) Provide better metal distribution.

The process is somewhat flexible and any one feature can be emphasized more than some of the others. Ordinarily, it is not possible to secure all these benefits at their maximum at any one time.

Reference

1. Patents applied for by the Westinghouse Electric Corp. Process marketed by the Hanson-Van Winkle-Munning Co. of Matawan, N. J.

Single-phase rectifiers in parts department of Bulova Watch Co.

Rectifiers for Electroplating

By Louis W. Reinken, *Chief Engineer, W. Green Electric Co., Inc., New York City*

Rectifier equipment is now delivering some millions of amperes for electroplating, electrocleaning, and anodizing. It is evident that the rectifier is here to stay and is a full fledged partner of the motor generator in the electroplating business.

Recognizing this, we present the first in a series of articles which will discuss rectifier equipment comprehensively in an attempt to cover the different angles of interest to the laboratory man, the plating operator, the plant electrician, and top management.

The author welcomes suggestions which will guide him in the preparation of material for future articles in this series.—Ed.

JUST how many rectifiers were installed in electroplating plants during the last few years is not known accurately, but most rectifier manufacturers were running at full capacity, and still are. There is no longer any doubt about the capacity of well-built rectifier equipment to stand the gaff—not after a good many units have had the equivalent of more than ten years use compressed into three or four years of round-the-clock continuous operation. The question now is, not "Will it work?"—but, "Where does it fit in best?"

Therefore, this series of articles will aim to bring the reader up to date on rectifier equipment, explaining general construction, type of rectifier elements used, performance which may be expected, what factors should be considered in specifying rectifier units, planning installations to utilize the special features of rectifier equipment, and notes on maintenance and trouble shooting.

Basic Rectifier Circuits

Rectifier units are, essentially, very simple devices. It is the associated gadgets for remote control, overload protection, etc., which make them seem more complicated than they really are.

The heart of any electroplating rectifier unit is the assembly of metal plates or discs which do the rectifying; i.e., which convert alternating current into direct current. No one, not even the physicists involved in the original development of the different types of metal rectifiers, knows exactly what goes on inside a metal rectifier. However, this should cause no alarm, because too much is not known about how a motor generator operates and this type of D.C. power supply has been used pretty successfully for over a century.

It is known that any rectifier plate will pass electrical current more readily in one direction than another. It has a higher resistance in one direction than the other. Therefore, if it is connected in series with an alternating voltage it allows current to flow quite readily in one direction and tends to prevent its flow in the opposite direction. Such a simple rectifier (see Figure 1) is called a "single-phase half-wave" and

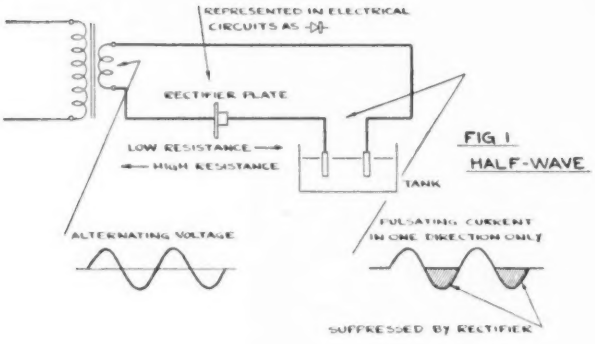


FIG 1
HALF-WAVE

delivers a pulsating current in one direction only. The circuit shown in Figure 1 will work; it is actually possible to perform some simple electroplating processes (copper, silver, gold) perfectly, but it is inefficient and should be used only for very small, low cost units. So far as we know, this circuit is not used in electroplating rectifiers at the present time.

A much more efficient and satisfactory rectifier for single phase supply is the full-wave type which delivers both sides of the alternating supply to the plating tank. There are two of these—the center tap, which has two rectifier arms, and the bridge which has four. Both of these are equally satisfactory for electroplating and deliver identical "kinds" of current to the tank. (Figure 2).

Which of these circuits is chosen depends upon the kind of metal rectifier plates used and upon how much voltage is needed at the plating tank. As an example, the center tap circuit is generally used with selenium rectifier plates if not more than about 6 or 7 volts is needed, and the bridge circuit for 12 volts or higher.

The single-phase rectifiers are the simplest to build and are entirely satisfactory for a great many electroplating processes and for electrocleaning of metals prior to plating. Since most laboratories have the usual 110 to 120 volt A.C. supply available, these small units are widely used in laboratory work. They are compact, noiseless and simple to use. A portable unit with a capacity of 25 amperes and a range of from zero to 6 volts is shown in Figure 3. A number of manufacturers make single-phase units in capacities up to about 150 amperes at 6 volts, and in lower capacities at higher voltages of 12, 18, 24, and 48 volts.

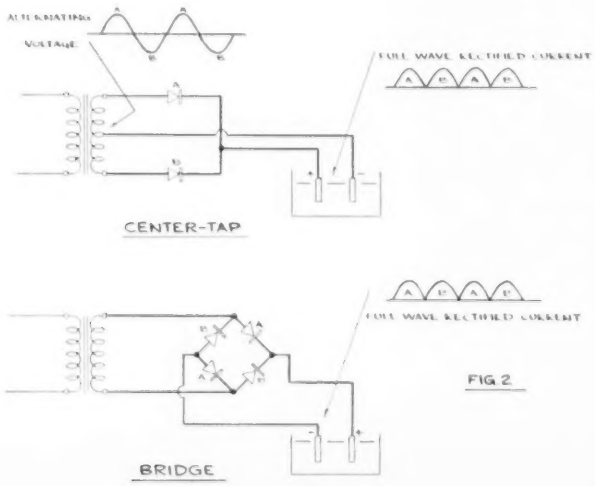


FIG 2

Possible Difficulties with Single-Phase Rectifiers

Although thousands of single-phase units are in use and have proved to be entirely satisfactory for most plating processes, it is necessary to point out that trouble may occur with critical processes, particularly with hard chrome plating. In two plants that the writer knows, the results obtained with a hard chrome bath in the laboratory, operated from a single-phase rectifier were not identical with results obtained from the same bath in the factory supplied from three-phase rectifiers or with generators. When the single-phase units were replaced by small three-phase units, then laboratory results were identical with factory results.

The explanation evidently lies in the ripple or "bumpiness" of the current delivered by the single-phase rectifier. Figure 4 shows how an average voltage of 6 volts (as indicated by a D.C. voltmeter) reaches peak values of about 9.4 volts and minimum values of zero. Of course, all this occurs very rapidly—

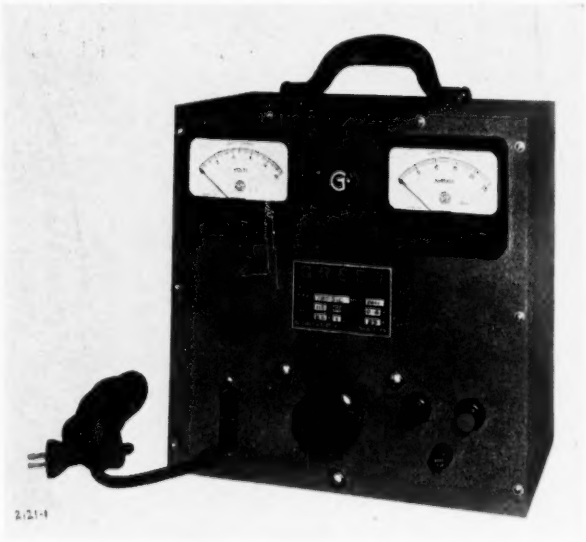


Figure 3. Single-phase portable rectifier.

120 times per second—so that the ripple can be detected only with special instruments such as a cathode ray oscilloscope.

However, the ripple is there, and it is believed that this rapid fluctuation about the average value accounts for the difference between single-phase and three-phase results. Three-phase rectifiers, incidentally, have been used successfully for every power source process in industry.

An interesting point on the same subject is that a number of operators have used single phase rectifiers for chrome plating with entire success. The writer believes that these single-phase operators have simply found out, by experimenting, what combination of tank voltage and bath conditions will give satisfactory results when single-phase rectifiers are used.

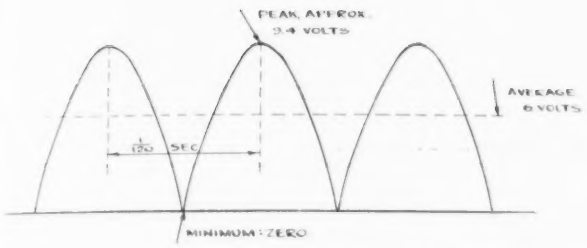


FIG.4

SINGLE PHASE RIPPLE

A thorough investigation into the reason why single-phase and three-phase (or motor generator) results are not always identical in hard chrome plating is an interesting piece of research work waiting to be done.

Since hard chrome plating usually requires high current densities and large power supply units, the small single-phase rectifiers are not generally used for this work, but only the three-phase type. If rectifiers are used in the laboratory to check full-scale operation, particularly for hard chrome plating, small three-phase units are recommended in preference to single-phase units. However, for all other processes the single-phase units appear to be entirely satisfactory, and in fact are used in quantity in regular production on batches of small parts. An example of such usage is in the parts department of the Bulova Watch Company who use dozens of single-phase units, thus providing a separate power supply unit for each operator. (See photograph.)

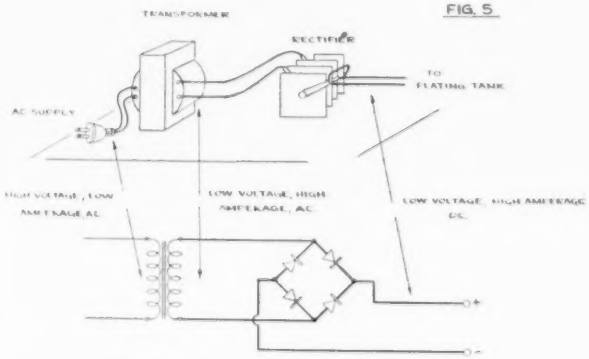


FIG. 5

SINGLE PHASE BRIDGE RECTIFIER

Transformers

Later, the three-phase circuits used in larger rectifier units will be discussed, but the second most important element in any rectifier unit, the transformer, will now be considered.

The transformer is so well known that it needs no introduction; merely an explanation of why it is necessary in an electroplating rectifier.

The standard alternating current supply available in most homes and in many plants in this country is "110 volts" which may actually be anywhere between as low as 95 volts and as high as 125 volts. Radio set manufacturers estimate a good national average is 117 volts. In factories, still higher voltages—220, 440, and 550 volts—are used, and these are generally three-phase systems instead of the familiar single-phase "2-wire" system.

In any case, these A.C. voltages—110 to 550—are much higher than the D.C. voltages used for electroplating, which varies from about 1 volt up to about 8 volts, and even higher for barrel plating. Therefore, if the plant A.C. voltage were simply converted to D.C. the voltage would be far too high for electroplating—or even for anodizing. The problem is to step down the A.C. voltage to a lower value before it is rectified.

To step down the voltage, transformers are used. The primary, or high voltage side is supplied from the A.C. lines in the plant, and the low voltage side is connected to the rectifier elements which, in turn, deliver low voltage D.C. to the plating tank. These steps are shown graphically in Figure 5, showing also the corresponding circuit schematic.

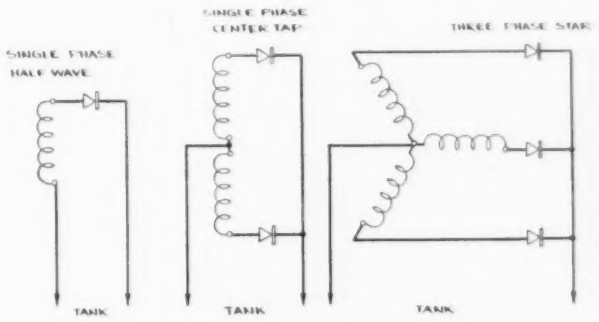


FIG. 6

CIRCUITS DERIVED FROM HALF WAVE

The sole function of the main, or step-down, transformer in an electroplating rectifier unit is to step down the A.C. voltage in the plant to a much lower A.C. voltage to be delivered to the rectifier assembly. In doing this the small number of amperes drawn from the A.C. supply is converted into a much larger number of amperes (perhaps several thousand) and for this reason the secondary, or low voltage, side of the transformer is wound with very heavy copper conductor.

Providing good materials are used in a transformer and the design is not skimped, trouble with this important component is practically zero. Furthermore a well-built transformer is one of the most efficient

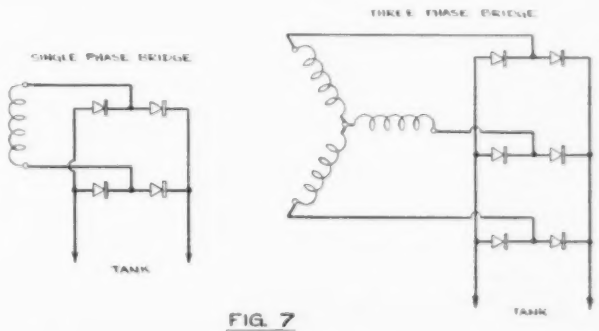


FIG. 7

BRIDGE CIRCUITS

devices known—having an efficiency of 95% or more.

Transformers for electroplating use should have the best possible insulation to avoid the possibility of shock to the operator. Atmospheric conditions in most electroplating plants are usually severe, and for this reason inorganic insulation such as fibre glass and mica are desirable for electroplating transformers.

Three-Phase Rectifier Circuits

Electroplating rectifiers with capacities above one kilowatt (6 volts 150 amperes is 900 watts) are generally of the three-phase type for connection to the 220, 440 or 550 volt supply in the factory. Three-phase circuits are more efficient than single-phase circuits. These three-phase circuits appear to be more complicated than single-phase circuits but are actually mere extensions of the single-phase circuits already discussed.

Thus, Figure 6 illustrates the progression from

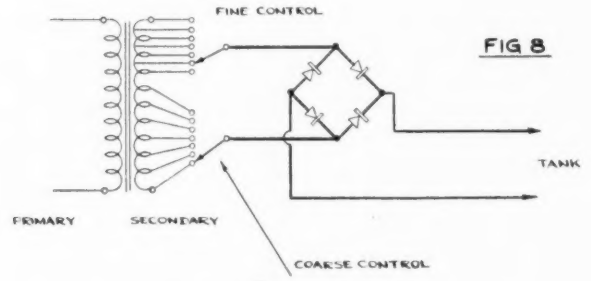


FIG 8

VOLTAGE CONTROL-TAPPED SECONDARY

"single-phase half-wave" through "single-phase center tap" to "three-phase star." Note that 1, 2, and 3 rectifier arms are used, respectively. The three-phase star circuit is sometimes called "three-phase Y" or "three-phase half-wave." This latter designation should, in the writer's opinion, be avoided, since "half-wave" may imply poor efficiency by association with the unsatisfactory performance of the *single*-phase half-wave circuit. Actually, the three-phase star circuit is entirely satisfactory, being substantially more efficient than the single-phase full-wave circuits and in some cases, may be also more efficient than the three-phase bridge circuit.

The three-phase bridge circuit, shown in Figure 7, requires six rectifier arms, or twice as many rectifier plates as the three-phase star for the same current, but double the voltage may be obtained.

Either of these circuits is entirely suitable for electroplating, anodizing, etc., and a choice between them depends upon the characteristics of the metal rectifier elements used and the D.C. voltage required, just as in the case of the choice between single-phase center tap and bridge circuits.

In equipment using copper oxide or magnesium copper sulphide rectifier elements, the three-phase bridge circuit is generally used since (for these lower voltage elements) the same *total* number of *plates* would be required for the star circuit, and the star transformer is slightly more difficult to build. When using selenium rectifier plates, which have a much higher voltage rating per plate than either the copper oxide or magnesium copper sulphide, the star circuit is preferred for outputs up to 6 or 8 volts, since the bridge circuit would require twice as many plates and would actually be less efficient than the star. This is one reason why selenium units are generally more compact. Above about 8 volts the preferred choice for any type of rectifier element is the bridge circuit.

Voltage Control

Excepting, possibly for electrocleaning, it is desirable to provide some means of controlling the D.C. voltage delivered to the tank. Although the rectifier may be the "basic" type (no voltage controls) with a tank rheostat in the low voltage D.C. circuit, the trend particularly in new installations, is toward A.C. voltage control as part of the rectifier. Whatever the circuit and arrangement of parts, the general idea is to control the D.C. voltage delivered from the rectifier by controlling the A.C. voltage supplied to the rectifier elements. A.C. voltage can be lowered or raised by using the transformer principle which has several advantages compared to control by means of a rheostat in the D.C. circuit:

(1) There are no resistive losses and consequently no waste of power in the form of heat.

(2) The range of voltage control is unlimited and may be extended down to zero if desired, even if only small tank currents are needed.

(3) The voltage drop across a tank rheostat depends to a considerable extent upon the tank current, and the rheostat must be selected to match the usual tank current. It has little or no effect on voltage if the tank current is low.

Basically, there are two places where A.C. voltage control may be inserted in a rectifier unit—between the A.C. supply and the primary of the step-down transformer, or at the secondary of the step-down and

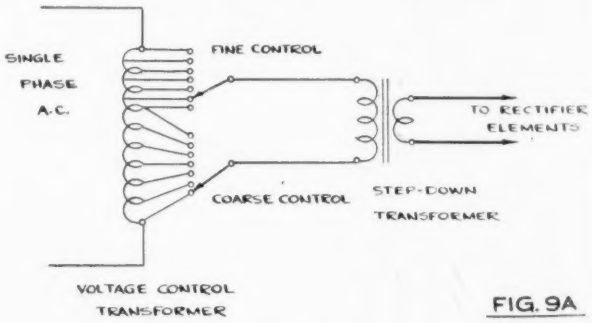


FIG. 9A

SINGLE PHASE VOLTAGE CONTROL

voltage control from the same transformer. Unfortunately, the currents appearing on the secondary side may be quite high (50% or more of the D.C. rating of the complete rectifier unit) and even the physical problem of "tapping" a secondary which has a total of only 5 or 6 turns is enough to rule out the idea for large units. Switches needed to deal with two or three thousand amperes at 8 or 10 volts would be enormous.

Therefore, tapped secondaries, as shown in Figure

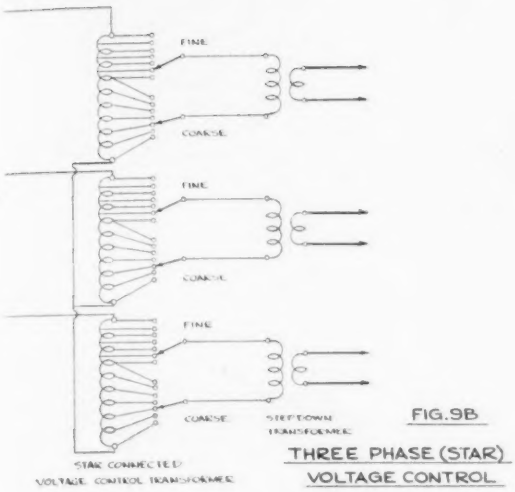


FIG. 9B
THREE PHASE (STAR) VOLTAGE CONTROL

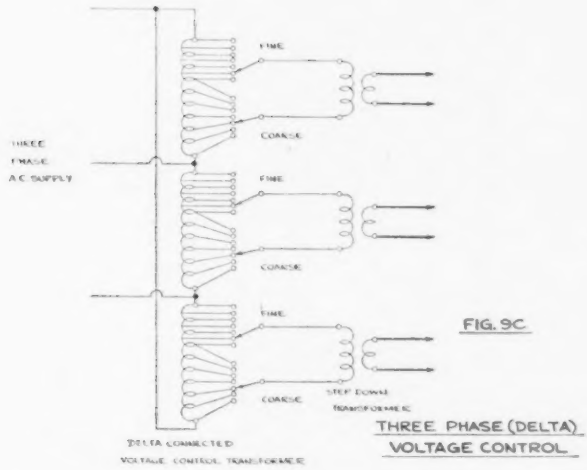


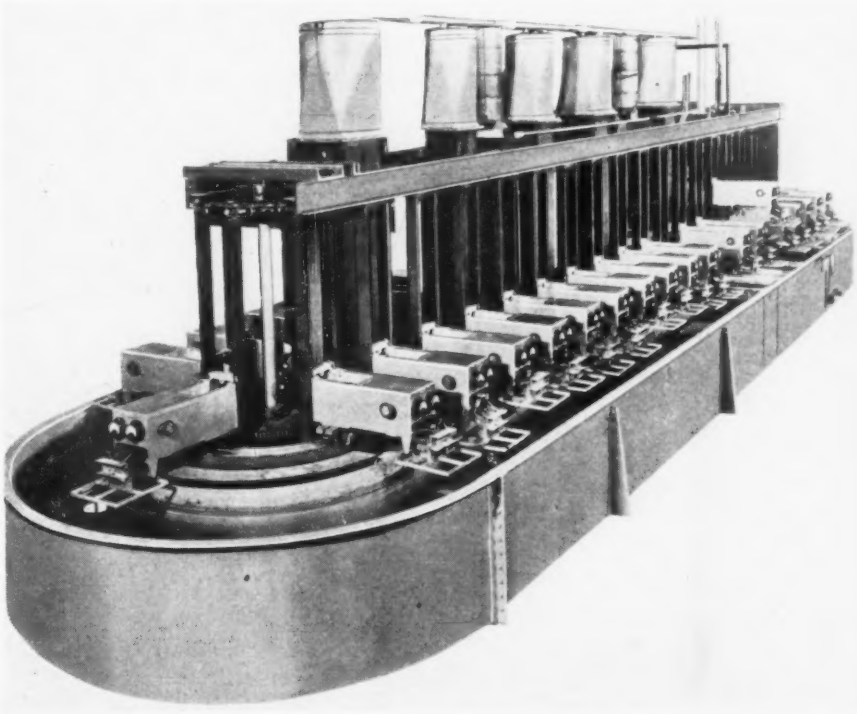
FIG. 9C
THREE PHASE (DELTA) VOLTAGE CONTROL

8, are generally used only on the smallest single-phase units, where the currents are measured in amperes, instead of hundreds or thousands of amperes, and for which practicable tap-selector switches are available.

Tapped Autotransformer Voltage Control

The most widely used method of voltage control is a tapped auto-transformer, with selector switches, inserted between the power supply source and the primary of the rectifier step-down transformer. Figure 9 shows a typical single-phase circuit and the three-phase equivalents. In the three-phase circuit all the coarse switch sections are connected to a single knob, and all the fine sections to another knob. Comparison of the two circuits will show that the three-phase circuit is the same as the single-phase circuit but with three tapped sections, one for each of the three-phases, and coarse and fine selector switches for each phase. Figure 9B and 9C are identical excepting that in 9B the voltage control transformer is "star connected" and in 9C is "delta connected." If the delta circuit is used for 220 volt supply the maximum voltage handled by the switches and delivered to each primary of the step-down transformer is 220 volts. If the star circuit were used for 220 volts the maximum voltage would be 220 divided by the square root of 3 or 127 volts. This means that the selector switches, for the same total power, would have to carry nearly twice as much current. Hence, delta connection of voltage transformer is preferable for supply line voltages of 200 to 300 volts.

Conversely, the star circuit is preferred to the delta for 440 or 550 volt supply in order to reduce the voltage handled by the selector switches which are designed for voltages up to about 300 volts A.C.



Full automatic conveyor elevator type plating machine with individual control on each rack. Note exhaust risers assembled through center of framework.

(Courtesy Hanson-Van Winkle-Munning Co.)

Disposal of Cyanide Wastes

By John G. Dobson, *Wallace & Tiernan Co., Inc., Newark 1, N. J.*

The cyanide radical which has been found to be toxic to fish in concentrations as low as .025 ppm. can be successfully eliminated from the wastes resulting from plating, case-hardening, and other industrial processes by the addition of approximately 4 ppm. of chlorine per part of CN at controlled pH's above 8.5. The toxicity of such cyanide wastes, the various methods of treatment which have been used, and the results of laboratory and plant-scale operations of both the lime sulphur and chlorination methods are discussed.

CYANIDE wastes from plating, heat treating, and other industrial processes are the most toxic materials commonly discharged into sewage systems and into surface streams. Fortunately, simple, economical and efficient processes have now been developed for rendering these toxic wastes innocuous to fish life, to sewage treatment processes and water users.

The toxicity of cyanide and its compounds varies with pH, concentration of other ions present, temperature, oxygen content, activity of the fauna present, and various other factors.[1] It is difficult to determine the exact dosage which is lethal to any particular fish under any particular conditions. However, the list below will indicate the general range of toxicity.

Its toxicity to animals and human beings is also high. In the handling of any cyanide compound or in the treatment of cyanide waste, care should always be taken to prevent the formation of volatile HCN, since as little as .048 per cent of HCN in the air is immediately dangerous to life without respiratory protection. Even with oxygen mask protection, one per cent of this gas in the air is dangerous to human life upon a ten-minute exposure. Lower concentrations or shorter periods of exposure to this gas may cause non-fatal poisoning, the symptoms of which include quickly developed convulsions followed by multiple paralysis and slow and shallow respiration.[2]

TABLE I

Formula and Reference	*Name*	*Concentration*	*Effect*	*Fish*
NaCN [1]	Sodium Cyanide	10 ppm.	Kills in 4 minutes	Shiner
NaCN	" "	5 ppm.	Kills in 12 minutes	Shiner
NaCN	" "	2 ppm.	Kills in 17 minutes	Shiner
NaCN [3]	" "	1 ppm.	100% mortality in 20 minutes	Trout
NaCN [2]	" "	0.8 ppm.	100% mortality in 24 hours	Adult Minnows 4"- 6" Catfish 12"-15" Carp
NaCN [2]	" "	0.5–.7 ppm.	25% mortality in 24 hours	Adult Minnows 4"- 6" Catfish 12"-15" Carp
NaCN [2]	" "	0.4 ppm.	Destroyed balance in one hour	Adult Minnows 4"- 6" Catfish 12"-15" Carp
NaCN [2]	" "	0.3 ppm.	No effect in 24 hours	Adult Minnows 4"- 6" Catfish 12"-15" Carp
NaCN [3]	" "	0.050 ppm.	100% mortality in 124 hours	Trout
NaCN [3]	" "	0.020 ppm.	No effect	Trout Fingerling
KCNO [2]	Potassium Cyanate	264 ppm.	No effect in 24 hours	Adult Minnows

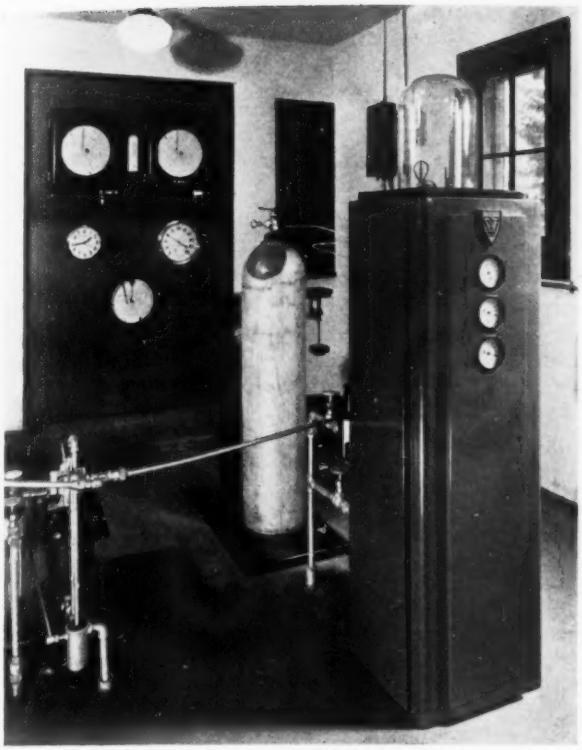


Figure 1. Chlorinator installation at Kilmer Creek District of North Vancouver, B. C.

Although it is less toxic, similar effect can result from the breathing of cyanogen chloride, a compound which can be readily produced by the chlorination of cyanide solutions under acid conditions. For this reason cyanide wastes should be treated before discharge into intercepting sewers. This is doubly important because ordinary sewage treatment processes do not eliminate cyanides.

Despite its toxicity, cyanide has formed an essential part of our industrial life—in metal plating operations, in steel hardening, in temporary prevention of rusting of ferrous materials following pickling, and in the refining of precious metals from their ores. In spite of its wide-spread use, few serious accidents involving cyanide have occurred, and with proper handling and proper waste treatment, cyanide can continue its important place in industry.

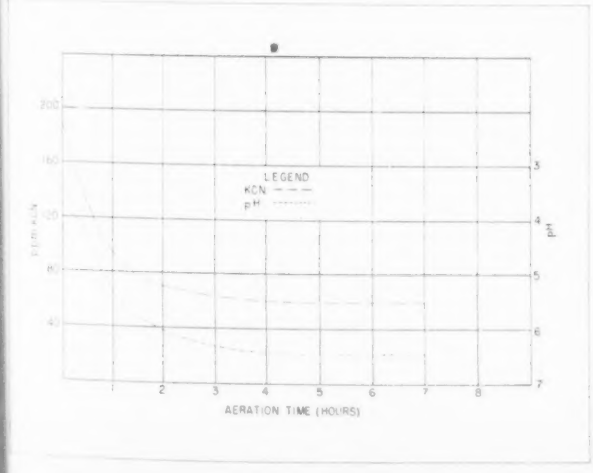


Figure 2.

Methods of Treatment

Several methods have been used for the disposal of cyanide-bearing wastes. Early in our industrial development, the material was disposed of into near-by streams, and dependence was placed on dilution for reduction of toxicity. This method has proved extremely dangerous, particularly during periods of low stream flow.[2, 7]

The difficulty in obtaining sufficient dilution to render cyanide wastes non-toxic can be realized from the fact that it requires seven million gallons of water to dispose of one pound of sodium cyanide.

Lagooning is another frequently used method of disposal. Experiments have indicated that under proper acid conditions a storage of slightly in excess of two hundred hours will substantially reduce the cyanide concentration of a waste.[8] Similarly, it is hoped that the cyanide which has not been oxidized

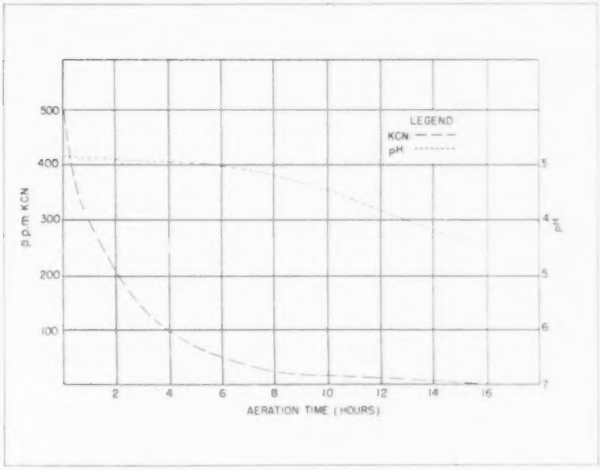


Figure 3.

by such ponding will remain in the soil and not reach the near-by streams. However, records are available of cases where cyanide buried in soil has washed out during spring freshets or periods of heavy rainfall and leached into streams in sufficiently high concentrations to cause death to the entire fish life of the stream for many miles. The reactions of cyanides with ferrous sulphate to produce Prussian blue has been suggested by Moir and Gray.[9] The same reaction has also been suggested for the reduction of acid mine wastes by reaction with the ferrous sulphate contained in these wastes.[10]

Where cyanide is in relatively high concentrations and the quantity of waste is large, acidification with carbon dioxide or flue gas,[11] or with carbon dioxide followed by sulphur dioxide,[12] has been used for the recovery of the CN radical. These methods find wide application in the mining industry, but the extensive apparatus necessary makes them uneconomical for low concentrations or small quanti-

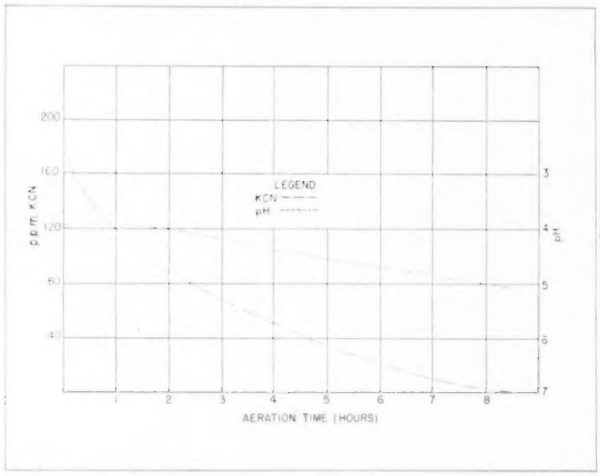


Figure 4.

ties of wastes usually found in metal finishing industries.

Acidification with strong mineral acids is an old process and improvements in the various methods of blowing air through the solution have been patented.[13, 14] Eldridge [15] carried on several tests to determine the feasibility of acidification with mineral acids followed by air scouring as a means for elimination of the toxic cyanide from plating baths which had been dumped. Laboratory results obtained from these methods are shown in Figures 2, 3 and 4, which are reproduced from his paper. Several plants have been built using this method, notably those in the automotive industry.[27] One installation was designed for the treatment of 4600 gallons of dumped plating waste. A hard rubber lined tank 40′ x 5′ x 3′ was erected complete with a high steel stack and air-tight doors. The concentrated cyanide waste, which contained 15,200 ppm., was run into the tank and ten carboys of concentrated acid were added. The cyanide content was reduced to 3,400 ppm. Thirteen additional carboys of concentrated acid were added and aeration carried on for sixteen hours. Resulting effluent was still toxic,[15] containing .975 ppm. of cyanide, and was sufficiently acid to introduce a serious disposal problem. While the design of the plants are such that the HCN discharged in the air is so dilute as to be relatively non-toxic, a power failure on the fans can well increase this concentration to the fatal level.

The Lime Sulphur Method

The use of sulphur and its compounds for the elimination of cyanides and cyanates from the washing waters used in coke oven gas production is old in the art.[16, 17] The use of lime sulphur was patented by Werlund and Gunick in October, 1938. In a general way the process consists of the addition of lime sulphur to cyanide solutions and the heating of those solutions to near the boiling point. Lime sulphur is a commercial compound containing the following: calcium polysulphide—70 per cent, calcium thiosulphate—5 per cent, free sulphur—5 per cent.

Cliver [20] has hypothesized the following possible reactions:

$$xNaCN + CaS{\cdot}S/x \rightarrow xNaCNS + CaS, \text{ or}$$
$$NaCN + S \rightarrow NaCNS, \text{ or}$$
$$NaCN + Na_2S_2O_3 \rightarrow Na_2SO_3 + NaCNS$$

The method may have some application for concentrated solution; but in most cases, the expense incompleteness of the reaction and toxicity of the resulting solution makes the method inapplicable. Figure 5 from data by Cliver [20] illustrates the time required for an excess of lime sulphur. The resulting concentrations of NaCN is, of course, highly toxic, and the resulting solution of NaCNS itself is toxic to fish in concentrations of about 600 ppm. When this material reaches acid conditions in sewers, hydrogen sulfide is formed, which itself is not only toxic but also highly corrosive to metals. If the waste is run into low pH sewage and afterwards chlorinated, the toxic HCN or CNCl is formed, depending on pH.

Experimental work at the University of Michigan [21] has shown that the addition of NaCNS to sludge during digestion will temporarily reduce the sludge digestion rate. In view of these difficulties it is believed that the lime sulphur method will be applicable to the disposal of cyanide wastes only under very unusual circumstances.

Chlorination

Extensive laboratory tests and several plant-scale installations have shown that cyanide can be economically and completely eliminated by the chlorination of the waste at controlled pH. Early theoretical discussions of the chlorination of cyanide wastes [15] and early experimental work [15, 20] indicated that the chlorination of a cyanide-bearing waste would cause either the evolu-

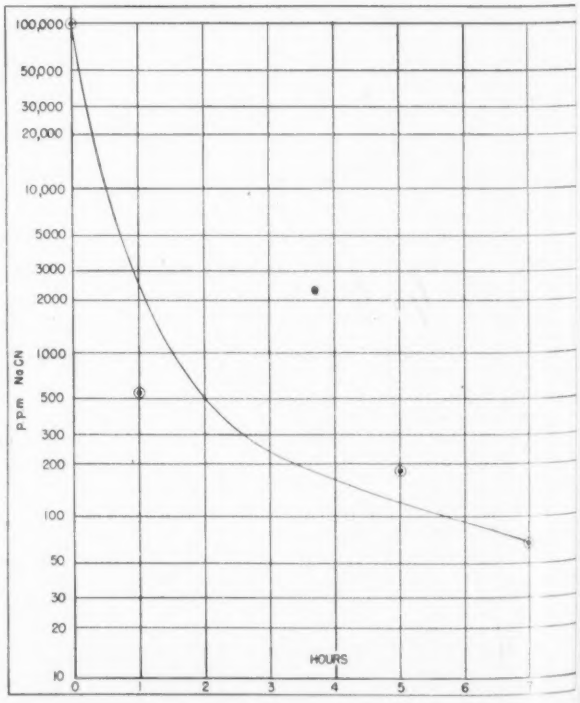


Figure 5.

tion of poisonous cyanogen chloride gas or cause an increase in toxicity of the solution by the presence of dissolved cyanogen chloride. Unfortunately, these experiments were carried out under acid conditions and the true reactions under alkaline conditions were not discovered.

Experimental work carried out in Germany resulted in a patent application by Helmut Beier [22] in November, 1939, which revealed the possibility of eliminating cyanide from sodium cyanide solutions by the addition of bleaching powder and slacked lime plus chlorine gas. This application has since been abandoned by the Alien Property Custodian. The first published record of a successful elimination of cyanides from industrial wastes using sodium hypochlorite was published in 1941.[23]

(Continued next month)

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This Is Washington

By George W. Grupp
Metal Finishing's Washington Editor

Major Problems of the New Congress

The major problems of the new 80th Congress are taxation, balancing the budget, and labor. Labor seems to stand at the head of the list. It is doubtful if ever in the history of the United States there were so many labor bills dropped into the legislative hopper in a fortnight's space of time as there were during the first two weeks of the present Congress.

This deluge of labor bills has made it difficult for union leaders to keep pace with them. Naturally, the labor leaders are opposed to any legislation which will deprive them of any of their present power.

If Congress were to hold separate hearings on each labor bill it would take a year or more of time. For this reason Congress is at present holding joint hearings on the most important labor bills because the 80th Congress is determined to pass some labor legislation about the first of March to prevent another serious major strike and to offer some relief to employers who are being worried by portal-to-portal lawsuits.

For one thing, legislation must be passed which will remove the present uncertainities as to what is meant by the terms "collective bargaining," "work," "overtime," and "work-week." At the present time unions contend in their portal-to-portal lawsuits that work includes (1) the time spent changing clothes; (2) the time spent checking or preparing equipment; (3) the time spent preparing reports; (4) the time out for company medical examinations; (5) the time spent walking or traveling on the employer's premises; (7) the time spent waiting to be paid; (8) the time spent eating meals on duty; (9) the time spent resting for periods not exceeding twenty minutes; (10) the time spent receiving instruction on work; (11) the time spent remaining on call during production interruptions; and (12) the time spent in washing up if it requires more than five minutes.

No one knows what sort of omnibus labor measure will be passed, but it will undoubtedly concern itself with such subjects as (a) protecting the dignity, health and self respect of workers; (b) the freedom of employers to talk with employees; (c) interstate commerce as applied to labor contracts; (d) implied, indirect or actual amendments of the Norris-LaGuardia Act; (e) amendments of the Clayton Act; (f) amendments of the National Labor Relations Act; (g) amendments of the Fair Labor Standards Act; (h) compulsory arbitration; (i) Federal mediation machinery; (j) jurisdiction strikes and secondary boycotts; (k) closed shops; (l) employer contributions to welfare funds; and (m) foremen unions.

Some of the labor and tax bills which are of interest to readers of *Metal Finishing* are the following measures:

H.R. 1. A bill to reduce individual income tax payments. Introduced by Mr. Harold Knutson of Minnesota.

H.R. 8. A bill to amend and revise an act approved July 5, 1935, entitled "An act to diminish the causes of labor disputes burdening or obstructing interstate and foreign commerce, to create a National Labor Relations Board, and for other purposes." Introduced by Mr. Howard W. Smith of Virginia.

H.R. 17. A bill to declare and protect the rights of the public when labor disputes result in, or threaten to result in, danger to public health or safety. Introduced by Mr. James C. Auchincloss of New Jersey.

H.R. 40. A bill to provide for the amendment of the Fair Labor Standards Act of 1938, and for other purposes. Introduced by Mr. Emanuel Celler of New York.

H.R. 46. A bill providing for the issuance of documentary evidence of United States citizenship. Introduced by Mr. Charles R. Clason of Massachusetts.

H.R. 62. A bill to fix the personal exemption and credit for dependents for purposes of income tax. Introduced by Mr. Albert J. Angel of Michigan.

H.R. 76. A bill to declare and protect the rights of the public when labor disputes result in, or threaten to result in, danger to public health or safety. Introduced by Mr. Christian A. Herter of Massachusetts.

H.R. 86. A bill to diminish the causes of labor disputes burdening or obstructing interstate and foreign commerce, to diminish unemployment to establish a national policy for assuring continuing employment in a free competitive economy and to protect the right to work. Introduced by Mr. Clare E. Hoffman of Michigan.

H.R. 87. A bill to make certain labor practices and boycotts unlawful. Introduced by Mr. Clare E. Hoffman of Michigan.

H.R. 89. A bill to amend sections 203 (52 Stat.

1060), 207 (b) (53 Stat. 1063), and 216 (b) (52 Stat. 1069) of title 29 of the United States Code, the same being the Fair Labor Standards Act of 1938. Introduced by Mr. Clare E. Hoffman of Michigan.

H.R. 90. A bill to protect the public welfare when injuriously affected by strikes in public utilities. Introduced by Mr. Clare E. Hoffman of Michigan.

H.R. 121. A bill to repeal the Price Control Act and the Stabilization Act. Introduced by Mr. Chester E. Merrow of New Hampshire.

H.R. 122. A bill to protect the right of individuals to work by prohibiting certain practices in the field of labor relations. Introduced by Mr. A. L. Miller of Nebraska.

H.R. 158. A bill to increase the normal tax and surtax exemption from $500 to $1250 and the exemption for dependents from $500 to $750. Introduced by Mr. Thomas G. Abernethy of Mississippi.

H.R. 162. A bill to provide, in the case of wage and salary payments made in contravention of the Stabilization Act of 1942, that the lawful portion of such payments shall be allowed as costs or expenses of the employer. Introduced by Mr. Jack Z. Anderson of California.

H.R. 242. A bill to amend the Employers' Liability Act so as to limit venue in actions brought in United States districts courts or in State courts under such act. Introduced by Mr. John Jennings, Jr. of Tennessee.

H.R. 266. A bill to prevent interference with interstate and foreign commerce by sympathy or jurisdictional strikes or by boycotts. Introduced by Mr. A. L. Miller of Nebraska.

H.R. 267. A bill to prevent interference with interstate and foreign commerce by irresponsible acts of labor organizations and employers. Introduced by Mr. A. L. Miller of Nebraska.

H.R. 268. A bill to prevent work stoppages in industries vital to the public health or safety and public utilities whose rates are fixed by some government agency, and to provide a method for settling labor disputes in them. Introduced by Mr. A. L. Miller of Nebraska.

H.R. 269. A bill to prohibit discrimination in employment because of race, creed, color, national origin, or ancestry. Introduced by Mrs. Mary T. Norton of New Jersey.

H.R. 270. A bill to increase the minimum wage rate under the Fair Labor Standards Act of 1938 to 65 cents an hour. Introduced by Mrs. Mary T. Norton of New Jersey.

H.R. 297. A bill to exempt certain earned income of persons 65 years of age or over from the Federal income tax. Introduced by Mr. George B. Schwabe of Oklahoma.

H.R. 301. A bill to provide orderly procedures in collective bargaining, additional facilities for the mediation of labor disputes, and for other purposes. Introduced by Mrs. Margaret C. Smith of Maine.

H.R. 302. A bill to provide a basis for the settlement of industrial disputes vitally affecting the national health, security, or economy. Introduced by Mrs. Margaret C. Smith of Maine.

H.R. 475. A bill to provide for cooperation with States agencies administering labor laws in establishing and maintaining safe and proper working conditions in industry and in the preparation, promulgation, and enforcement of regulations to control industrial health hazards. Introduced by Mrs. Mary T. Norton of New Jersey.

H.R. 477. A bill to amend the Fair Labor Standards Act of 1938 with respect to the determination of employment time, and for other purposes. Introduced by Mr. Howard W. Smith of Virginia.

H.R. 532. A bill to increase the normal tax and surtax exemption from $500 to $1000 and the exemption for dependents from $500 to $800. Introduced by Mr. J. Harry McGregor of Ohio.

H.R. 575. A bill amending the Internal Revenue Code section 25 (b) (1); paragraphs 400 and 1622(c) (1); and other necessary sections, charts, tables, or other data which might be inconsistent with the following amended exemption providing for an increase in the income-tax exemption bracket of single persons to $2,500 on their yearly gross income, and for an increase in the income-tax exemption bracket of married persons to $5000 on their yearly gross income. Introduced by Mr. Frank L. Chelf of Kentucky.

H.R. 613. A bill to define "work" or "work-week" as referred to in the Fair Labor Standards Act of 1938. Introduced by Mr. Emory H. Price of Florida.

H.R. 679. A bill to regulate in the United States Court of Claims and in the United States District Courts suits for payment for the infringement of patents infringed by or for the Government and for the use of inventions used by or for the Government, and for the better protection of the rights of inventors and owners of patents, and to stimulate the making of inventions useful to the Government and insure payment for the use thereof when used by or for the Government and its contractors. Introduced by Mr. James W. Wadsworth of New York.

H.R. 725. A bill providing for an Industrial Relations Act of 1947, to amend and supplement the National Labor Relations Act, to create a commission for the settlement of industrial disputes, to facilitate the free flow of commerce, and for other purposes. Introduced by Mr. Francis S. Case of South Dakota.

H.R. 787. A bill to provide a basis for the settlement of industrial disputes vitally affecting the national health, security, or economy. Introduced by Mrs. Margaret C. Smith of Maine.

H.R. 880. A bill to repeal the National Labor Relations Act and to diminish the causes of labor disputes burdening or obstructing interstate and foreign commerce, to create a National Labor Mediation Board to protect the public health, safety, and welfare, and other purposes. Introduced by Mr. Clare E. Hoffman of Michigan.

H.R. 957. A bill to amend the Fair Labor Standards Act of 1938, as amended, and for other purposes. Introduced by Mr. John Jennings, Jr. of Tennessee.

S. 27. A bill to provide for suspending the enforcement of certain obligations against the operators of gold and silver mines who were forced to cease operations because of the war. Introduced by Mr. Pat. McCarron of Nevada.

S. 55 A bill to provide additional facilities for the mediation of labor disputes affecting commerce, to improve the procedures of collective bargaining, to equalize legal responsibilities of labor organizations and employers, and for other purposes. Introduced by Messrs. Joseph H. Ball of Minnesota, Robert A. Taft of Ohio, and H. Alexander Smith of New Jersey.

S. 70. A bill to exempt employers from liability for portal-to-portal wages in certain cases, and for other purposes. Introduced by Mr. Alexander Wiley of Wisconsin.

S. 71. A bill to prohibit the closed shop in industries affecting commerce. Introduced by Mr. Harry F. Byrd of Virginia.

Tinplate Controls Relaxed

All tinplate controls were relaxed by the Civilian Production Administration by amending container order (M-81). The tinplate controls were liberalized by eliminating the A, B and C sequence in the permitted use of tinplate for food packing and by revoking Direction 9 to steel order M-21. In amending Order M-81 no changes were made in restricting the amount of tin coating which may be used in tinplate for cans.

Copper Recovery from Plated Iron Scrap

For one dollar one can get a copy of report PB-20475, written in German by Herr Westerholt on the subject of "Electrolytic Process for the Recovery of Copper and Copper Alloys from Copper-plated Iron Scrap."

Zinc Supply Expected to Be Ample in 1947

It looks as if the supply of zinc in 1947 will be ample to meet the needs of the nation. Experts are of the opinion that the slab zinc production in 1947 will be about 850,000 tons. The zinc consumption in 1946 has been estimated at 800,000 tons.

Platinum Consumption and Imports in 1946

The firm of Baker & Company Incorporated, the world's largest dealer and refiner of platinum metals reports that "during the first nine months of 1946 the United States producers of platinum to all consuming industries averaged 19,775 troy ounces, monthly, including 12,734 ounces for jewelry and decorative uses, according to United States Bureau of Mines reports. In the same period United States imports averaged 15,000 ounces monthly."

Metal Outlook for 1947

Metal experts are of the opinion that the shortage of copper will remain acute until this forthcoming summer; tin production is expected to remain short of demand throughout 1947; the platinum market is expected to become stabilized by about July 1947; to meet the domestic demands for lead during 1947 about 200,000 tons will have to be imported; the zinc supply and demand is said to be in balance throughout the world; and there will be sufficient silver to meet domestic demands throughout this year.

Tin Parley Stalled

The United States-Bolivian tin negotiations were stalled when the Reconstruction Finance Corporation was opposed to an increase in price, and when it was unwilling to enter into an agreement which included reactive payment clauses.

Silverware Industry Expected to Have Big Year

According to E. C. Stevens, president of the International Silver Company, production of the silverware industry is expected to surpass "that of our best peacetime year." He also added that "there is no assurance that production during 1947 will catch up with the large backlog of sterling and plated silver orders built up during the war years. We may be well into 1948 before this happens."

Tin Imports in 1946

Conservative tin experts estimate that the normal tin demand is 175,000 tons per year. They also estimate that the annual requirements of the United States is 75,000 tons rather than 90,000 tons as estimated by the Civilian Production Administration. During 1946 the imports of pig tin and concentrates were 13,760 tons during the first quarter; 13,055 tons during the second quarter; and 11,697 tons during the third quarter.

Chile Asks U. S. to Drop Copper Import Duty

The Chilean Government recently sent a memorandum to the United States Government asking we abolish the 4 cents a pound import duty on copper.

Slab Zinc Production During Past Five Years

The American Zinc Institute reports that the total production of slab zinc during the calendar year 1946 amounted to 759,212 tons as compared with 799,462 tons in 1945, with 901,330 tons in 1944, with 971,873 tons in 1943, and with 929,770 tons in 1942.

ELECTROPOLISHING WITH FLUOSULFONIC ACID

(*Continued from page* 67)

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32. Mannel, U.S. Pat. 2,330,170, Sept. 21, 1943.
33. Mason and Tosterud, U.S. Pat. 2,040,617, May 12, 1936.
34. Mathers and Ricks, *Proc. Indiana Acad. Sci.* **53**, 130-3 (1943).
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44. Wernick, *Sheet Metal Ind.* **22**, 1221-2 1229-33 1536-92 1951-8 (1945).
45. Yerger and Todd, U.S. Pat., 2,165,326, July 11, 1939.
46. Young and Brytczuk, *Masters Thesis*, Polytechnic Institute
47. Zmeskal, *Metal Finishing*, **43**, 280-6 (1945).
48. Zmeskal, *Met. Prog.*, **47**, 729-37 (1945).

Abrasive Methods—Surface Treatments—Control
Electroplating—Cleaning—Pickling—Testing

Shop Problems

METAL FINISHING publishes, each month, a portion of the inquiries answered as a service to subscribers. If any reader disagrees with the answers or knows of better or more information on the problem discussed, the information will be gratefully received and the sender's name will be kept confidential, if desired.

Finishing Sterling Silver

Question: We are using sterling silver and cutting same into desired patterns and also stamping same with a deep engraving. We then buff in the regular manner followed by rouging and here is where our trouble seems to begin. We have not been able to secure a proper cleaning method to dissolve the rouge and then cleaning same before lacquering. We would appreciate your kind assistance in what suggestions you have to offer, how we should dissolve and remove the rouge from our item and how to clean same leaving a very high brilliance, ready for lacquering.

Again, we have run into trouble with our lacquering. Your assistance on this would also be appreciated. Can we lacquer in damp days; have temperatures got very much to do with same?

M. B.

Answer: It is suggested that after buffing, the polishing compound be cleaned out of the recesses by use of an alkaline cleaner or an organic solvent. The articles should then be dried and rouged on a fairly clean wheel using a minimum amount of rouge.

This will bring up a high luster without packing rouge into the recesses.

When lacquering in damp weather, a retarder should be added to the lacquer. Your lacquer dealer can supply a retarder which is suitable for his lacquer.

Plating Screw Threads

Question: Many of our brass and steel parts having either internal or external screw threads are electroplated with cadmium, nickel, zinc, chromium, copper, silver, or brass. After plating, the threads must be within specific tolerances for Class 2 or Class 3 fits. Therefore, some allowances must be made in the machining for the metal added by plating. We are looking for a good, common sense procedure to control the parts before plating, so that they will be within proper limits after plating. We would like to avoid setting up special tolerances before plating because it might require special gages which we may not have on hand.

J. L. W.

Answer: If you wish to avoid setting up special tolerances before plating, it is suggested that the screw threads be pickled sufficiently before plating to decrease the diameter.

Polishing Aluminum

Question: We would like information concerning the polishing of aluminum cooking utensils from the initial greasing operation through to the high luster finish. If possible, this should include the grade or grit of material, type of wheel, and wheel speed for each operation.

We are new in this field and are experiencing difficulty in obtaining the high brilliant luster usually associated with these articles. The metal used is ⅛" thick aluminum sheet formed into utensils and polished on semi-automatic polishing machines. If the speed at which the utensil rotates in the polishing machine is a factor, would you please comment on this.

D. T. B.

Answer: The Aluminum Company of America recommends the following procedure for such utensils:

1. Cut down with tripoli composition, using a sewed muslin buff at 7,000 to 7,500 surface feet per minute.

2. Color with a soft silica composition, using an open muslin buff, which may be softened with spacers between the plies, at 7,500 to 8,000 surface feet per minute.

Phosphating

Question: In one of the Government specifications for finish in metal products they specify "shall be finished on the inside and outside with one coat of suitable phosphate treatment." This specification was recently revised and now reads "shall be thoroughly cleaned and painted inside and outside with one coat of suitable phosphate treatment."

There has been a great deal of discussion as to what is technically meant by "phosphate treatment." Up to now, it was our impression that it was a plating process. The revised specification indicating that this treatment is to be painted on raises the question whether or not it is a plating process or a painting process.

We, therefore, thought that your bureau can obtain the necessary information so that we may know the proper interpretation of this specification.

J. L. W.

Answer: Phosphating solutions can be applied by dipping, spraying or brushing. Manufacturers make solutions for each method of application.

Roman Gold Plating

Question: Please send to us any information you may have on Roman Gold Plating; the composition of the solution, and operation application, etc.

H. F. B.

Answer: The solution is as follows:

67% Potassium gold cyanide	4 dwt./gal.
Potassium cyanide	1½ oz./gal.

Add small amounts of lead carbonate gradually until the desired smut is obtained.

Operate at 160° F., 2-4 volts, stainless steel anodes. Relieve the highlights with bicarbonate of soda.

Silver Finishing

Question: We are interested in finding a source of supply of amorphous or soft silica of grades fine enough for finishing silver. We do not find any listed as such in your *Metal Finishing Directory* but would appreciate it if you could put us in touch with a supplier of this material.

W. H. C.

Answer: The *Metal Finishing Directory* contains suppliers of sodium ortho and metasilicates on pages 164 and 165. Also, any plating supply house listed under platers chemicals will without doubt have the grades of silica you require.

Nickel Tank

Question: In setting up our copper-nickel-chrome sequence, I have purchased a rubber lined tank. This tank was used during the war in an anodizing setup and to the best of my knowledge contained a nitric acid dip although I am not positive. I desire information as to the procedure necessary to neutralize whatever has been absorbed by the rubber in order to use it for a bright nickel tank.

M. D.

Answer: A common method of conditioning acid resistant tanks is to use a dilute solution of soda ash. Soak overnight with 5% soda ash, making sure that all parts of the tank are immersed. Then treat for about 10 hours with 5% solution of sulfuric acid. This should adapt the tank to the low pH nickel solution.

Gold Tarnish

Question: Enclosed herewith please find a few samples that we electroplated gold. A day or so later, before we could lacquer them, we found them tarnished as you can notice.

Would you kindly advise us the best method of removing the tarnish?

L. L.

Answer: It is noted that the gold is applied directly to the brass base. The effect is due to the brass tarnishing through the deposit. Although this tarnish may be removed by a cyanide dip, it is suggested that an intermediate bright nickel be applied for its prevention.

Silver Strip

Question: We have set up a silver strip according to your formula on page 177 of the 1945 edition of the *Plating and Finishing Guidebook*, 19 parts sulphuric and one part nitric acid.

This strip works quickly and efficiently but seems to leave the surface of the metal very hard. It takes a lot of extra work in buffing for lacq finish. Our work is brass musical struments, cornets, saxaphones, etc.

Is there any dip or solution wh we can use after the strip which give us a better surface to buff?

A. H. U

Answer: Aside from heat treatm of the brass, there is not much that be done in the way of chemical tre ment. However, we suggest that correct your wheel speeds and the co pounds used in the polishing ope tions. The supply house who sells the buffs and compounds should glad to help you directly in your sh

Blackening Nickel

Question: We are anxious to pu black finish on 20% nickel silver, would prefer a matte rather than glo finish but this is not as important getting as hard a finish as possi which will not flake off.

We have tried a black molybden plate over cadmium but this did adhere as well as we had hoped.

We would appreciate any help can give us.

J. M. B

Answer: It is suggested that you black nickel plating to finish parts. A formula for such bath be obtained from the *Plating and F ishing Guidebook*, or the work can done by any commercial plating sh The black nickel finish can be pla in either dull or bright, hard or s plate, and if done properly, will peel.

Professional Directory

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Patents

Detergent Composition

U. S. Pat. 2,412,944. *F. C. Bersworth, Verona, N. J., Dec.* 24, 1946

The method of forming an aqueous solution containing about one molar weight of the trisodium salt of ethylene diamine tetracarboxylic acid and about 1 molar weight of the sodium salt of stearic acid which comprises dissolving about one molar weight of the tetrasodium salt and the said amino acid in a volume of water, adding thereto about 1½ molar weights of stearic acid, and heating the solution for an extended time interval until the pH of the solution is stabilized at a pH of about 8, and filtering the solution while hot to remove the excess stearic acid present therein.

Hard Water Detergent

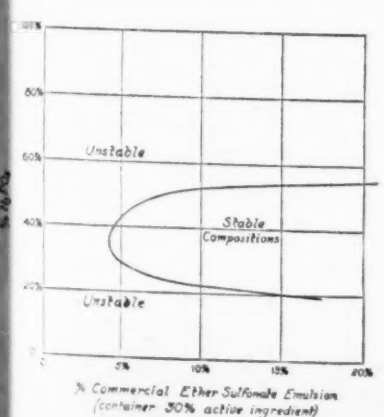
U. S. Pat. 2,412,943. *F. C. Bersworth, Verona, N. J., Dec.* 24, 1946

A detergent composition for use in hard waters, in water containing strong electrolytes, and in hard and saline waters, said composition consisting of a mixture of alkali metal-fatty acid soap compounds and 5% to 25% of the acid-trialkali metal salt of ethylene diamine tetracarboxylic acid.

Phosphoric Acid Detergent

U. S. Pat. 2,413,495. *C. P. Given, assignor to Virginia-Carolina Chemical Corp., Dec.* 31, 1946

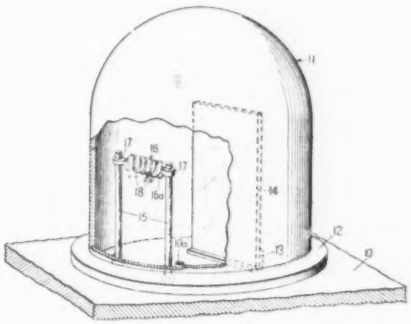
A detergent composition comprising an aqueous solution of phosphoric acid containing an aqueous emulsion of diisobutyl phenyl diglycol ether sulfonate, and triamylamine, characterized by high non-corrosive property towards metals due to the synergistic corrosion inhibiting property of the ether sulfonate and triamylamine, one hundred per cent by weight of the composition comprising from 4% to 15% of the ether sulfonate emulsion, from 20% to 53% of H_3PO_4, and from about 0.1% to 0.3% of triamylamine, the ether sulfonate emulsion containing 30% of the ether sulfonate.



Method of Evaporating Metals

U. S. Pat. 2,413,604. *W. H. Colbert and A. R. Weinrich, assignors to Libbey-Owens-Ford Glass Co., Dec.* 31, 1946

The method of producing coatings by evaporation of a metal of the silver chemical periodic table family from a filament selected from the group consisting of tungsten, tantalum, molybdenum and columbium, wherein the metal to be evaporated is alloyed with a metal selected from



the group consisting of platinum and palladium and is heated on said filament, and wherein said platinum or palladium causes the metal desired to be evaporated to wet, to adhere to, and to spread out over the filament surfaces and by the continued application of heat, to evaporate and to deposit upon an article to be coated.

Abrasive Supply System

U. S. Pat. 2,414,038. *C. M. Gossard, assignor to Pangborn Corp., Jan.* 7, 1947

In abrasive blasting apparatus, abrasive projecting apparatus, a main bin for storing a quantity of abrasive particles, means providing a main circuit for guiding abrasive particles from said main bin to said abrasive projecting apparatus and returning the projecting particles to said main bin, means providing an auxiliary

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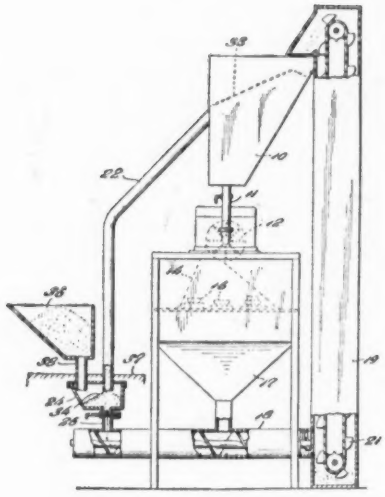
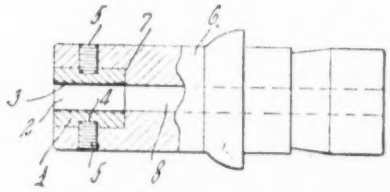


circuit operable to guide abrasive particles from the main bin into said main circuit as long as the abrasive particles in the main bin are above a predetermined point, a replenishing bin in open communication with said auxiliary circuit for supplying abrasive particles to the main circuit when abrasive particles cease flowing in the auxiliary circuit from the main bin.

Sandblast Nozzle

U. S. Pat. 2,413,167. *J. R. Bugley, assignor of one-half to R. Hunter, Dec.* 24, 1946



A nozzle element comprising a metal tube having its inner face impregnated with commercial diamond dust particles.

Ion Sorbing Process

U. S. Pat. 2,412,855. *R. W. Auten, and D. S. Herr, assignors to The Resinous Products & Chemical Co., Dec.* 17, 1946

The process of removing cations from fluids containing same which compromises bringing the cation-containing fluid into contact with an infusible cation-absorbing resin and thereafter separating said resin and said fluid, the resin being a product prepared by reacting at a pH of 4 to 10 by condensing together as the essential reactants (*a*) an aldehyde from the group consisting of formaldehyde, acetaldehyde, butyraldehyde, furfuraldehyde, and benzaldehyde, (*b*) a water-soluble salt of sulfurous acid and a metal of group IA of the periodic table, and (*c*) a member of the group consisting of melamine, melam, ammeline, thioammeline, methyl ammeline, ethyl ammeline, β,β'-bis-thioammeline diethyl ether, 2,6-diamino-1,3-diazine, 5-methyl-2,6-diamino -1,3-diazine, and 4-chloro-2,6-diamino-1,3-diazine, at a temperature at which these components form a condensate containing salt-forming sulfonate groups, the reaction being effected in the presence of a solvent for the condensate, the aldehyde being present in an amount between about 0.5 and 2 mols per reactive amino group in said member of the above class and said salt being present in an amount between about 0.05 and 1 mol per mol of aldehyde, heating the condensate dissolved in the solvent until a gel is formed, heating the gel at a temperature and for a time sufficient to form an infusible, resinous, porous mass, and comminuting said mass.

Abrasive Article

U. S. Pat. 2,412,599. *H. W. Buell, assignor to The Carborundum Co., Dec.* 17, 1946

A coated article having a surface film which is substantially free from cracks and checks and is stable to changes in atmospheric conditions, said film comprising the heat-hardened reaction product of a mixture comprising about 5-25 parts of a dense granular cuto-cellulosic flour and about 60 parts of a water-soluble reaction product of urea and formaldehyde, said flour having a bulk density greater than about 0.5, a total acidity greater than about 240, and a pH in the range of about 3.5-4.4.

In a method of making a heat-hardenable resinous adhesive which will cure to a surface film which is substantially free from cracks and checks and is stable to changes in atmospheric conditions, the step which comprises mixing a granular cuto-cellulosic flour having a bulk density greater than 0.5 and a total acidity greater than about 240 with a water suspension of a heat-hardenable reaction product of formaldehyde with a compound containing at least one carbon atom bonded to two nitrogen atoms, at least one of which is present as part of an amino group NH_2 said reaction produc bei heat-convertible to form an insoluble infusible resin.

Selenium Coated Rectifier Plat

U. S. Pat. 2,412,692. *C. E. Pete assignor to B-L Electric Mfg. C Dec.* 17, 1946

The method of making an im proved base plate for selenium rec fiers that comprises the roughen of the surface of a piece of met spraying molten nickel onto th roughened surface of the piece metal to form a plurality of upstan ing projections that constitute a th discontinuous layer of nickel to whi a coating of selenium can adhere we subjecting said sprayed piece metal to pressure to compress some the larger projections, heating sa discontinuous layer of nickel until can melt selenium brought into e gagement with it, and bringing se nium into engagement with said lay of nickel.

Wear Resistant Chromium

U. S. Pat. 2,412,698. *Hendrik van d Horst, assignor to Van der Horst Cor of America, Dec.* 17, 1946

A wearing member having a face chromium to operate in frictional co tact with another wearing membe there being in said face a multitu of depressions of various widths an of which the narrowest of the maj number observable looking direct at the face at a magnification of 5 diameters is between about 0.000 inch and 0.004 inch in width and th widest of said major number is be tween about 0.0003 inch and abo 0.0125 inch in width.

Iron Powder Production

U. S. Pat. 2,413,411. *W. J. Kr Dec.* 31, 1946

A process for producing substantia pure iron powder which comprises pa ing an electric current between an i pure iron anode and a cathode throu a molten salt electrolyte compr ing 10% to 60% ferrous chloride an substantially the remainder bei at least two salts selected from th group consisting of sodium chlori potassium chloride, and calcium chl ride and maintaining a current den ity at the cathode between 10 an 40 amperes per square inch.

(*Continued on page* 101)

LIXOL

Cowles FAST ACTING EMULSION SOLVENT CLEANER

LIXOL works fast and is a dependable emulsion cleaner for still tank, pre-soak or washing machine equipment. It can be used straight or diluted with water or kerosene.

- LIXOL penetrates
- LIXOL cleans thoroughly
- LIXOL prevents rust

Cowles Technical Service on Request

Prompt shipments from local stocks

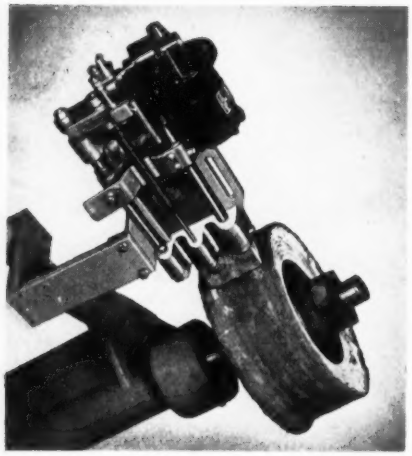
THE COWLES DETERGENT CO.

METAL CLEANER DEPT.

7016 EUCLID AVENUE • CLEVELAND 3, OHIO

Recent Developments

New Methods, Materials and Equipment for the Metal Finishing Industries



Buffing Compound Applicator

A new buffing compound applicator that has an intermittent feed control operating at the rate of 14 strokes per minute, affording a feed ranging from .0015" to .015" per stroke is announced by the George L. Nankervis Co., Dept. MF, 5442 Second Blvd., Detroit 2, Mich.

The applicator, it is claimed, can be mounted on any automatic machine (either right- or left-hand), and is said to be applicable to everything from the simple to complex multiple-stage buffing operations. It is driven by a totally enclosed geared head motor of either 110, 220 or 440 volt capacity. The quick action compound applicator clamp with adjustable features to compensate for variable thicknesses, and standard carrier are stated to accommodate any length stick of compound up to four inches. Special carriers for wider cakes are available.

Total weight is twenty pounds, thus permitting adaptation to floating heads without disturbing balance. It is claimed that this automatic method of applying the compound as compared to feeding by hand will effect savings upwards to forty per cent by making practical savings in compound, improving the quality and uniformity of the work and speeding up the job.

Stainless Steel Laboratory Filters

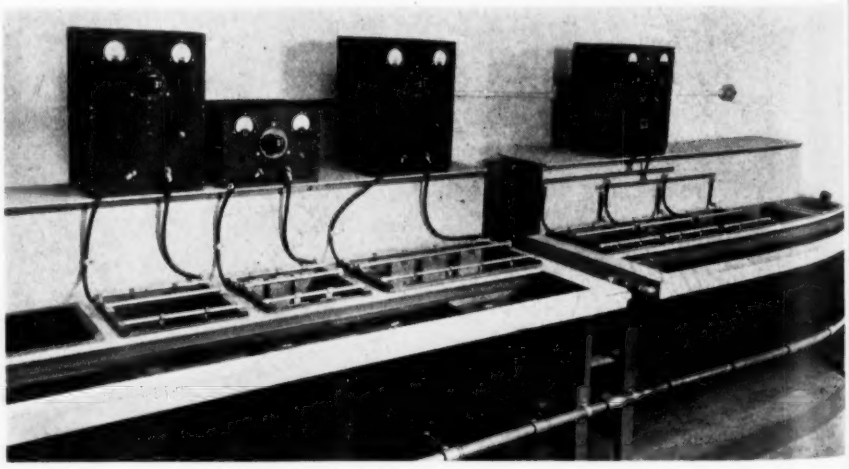
Production of stainless steel laboratory filters with porous stainless steel filter elements is announced by the Micro Metallic Corp., Dept. MF, 193 Bradford St., Brooklyn 7, N. Y. The line of filters includes filter crucibles, Buchner funnels, gas dispersion tubes and filter tubes.

These laboratory filters are made up by welding the porous stainless steel filter element into stainless steel filter bodies. In addition to freedom from breakage, the filters are said to show a number of other advantages; they can be heated and cooled without danger of cracking; they are light and uniform in weight; higher flow rates for any given pore size are obtained than with other types of filters; in addition to resistance to many acid conditions, the funnels are completely resistant to alkali attack.

The Buchner funnels are normally used without a paper covering, but the coarser grades may also be covered with filter paper, under which conditions higher flow rates are obtained than with perforated Buchners since the whole area of the filter paper is utilized, rather than the section just above the holes. Availability of industrial filter units made up with the same filtering material is a great advantage inthe application of the new filters to research and development work.

The filter crucibles may be used for the gravimetric analysis of all the common elements. Filter crucibles and Buchner funnels are also useful in accomplishing separations. Gas dispersion tubes are constructed in such a way that the whole volume of liquid may be filled with fine bubbles. The filters are available in five porosities ranging from very fine to very coarse.

Prefabricated Plating Plants



Announcement is made of a new line of prefabricated plating plants now being offered by the Unit Process Assemblies, Inc. The plants are shipped completely knocked-down and are said to be so arranged that a minimum amount of effort and tools are required to re-assemble.

Electrical, gas, water and drain lines are built in the equipment as are exhaust systems, when required. Each tank is equipped with a rectifier when an independent source of current is required and a rinse, pickle or

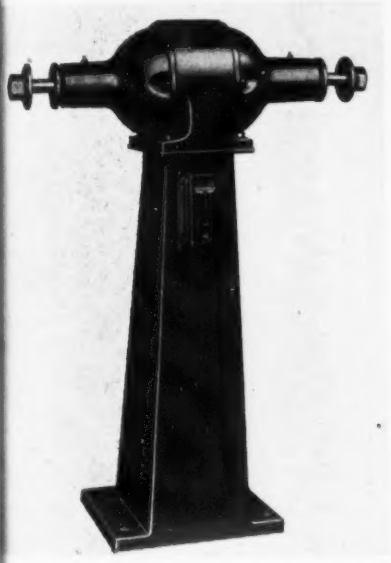
cyanide dip tank is included with each plating tank.

The plants are built in sections to facilitate erection of any combination desired with, it is claimed, the additional advantages of prefabrication. A large unit is one in which it is said that 5,850 square feet of assorted plating per day can be done in an approximate area of 600 square feet of floor space, including racking and unracking tables, and aisle space.

Where necessary, waste solutions may be neutralized before they are passed on to the sewer.

For further information write the Unit Process Assemblies, Inc., Dept. MF, 75 E. 4th St., New York 3, N. Y.

Direct Drive Lathes



An improved series of direct drive buffing and polishing lathes has been announced by the Lima Electric Motor Co.

The motors are totally-enclosed ball bearing type with push button starter and overload protection on the 2 HP and larger sizes. Spindles are made of chrome-nickel steel. A heavy pedestal suports the motor and various size arbors and speeds are available.

For further information and specifications, write to The Lima Electric Motor Co., Dept. MF, Lima, Ohio.

Package Plating Plants

Package plating plants in the approximate three to six thousand dollar

ABOVE: Loading end of Machine

LEFT: Discharge end of Machine

The cleaning of cylindrical brass cases following polishing and directly prior to plating, was a problem in a large metal parts manufacturing plant. The **OPTIMUS** Flat Conveyor Type Washing Machine shown above, now handles this operation in seven simple consecutive stages: Hot Alkali Wash, Drain, Hot Water Rinse, Warm Sodium Cyanide Wash, Cold Rinse to Sewer, Hot Rinse, Dry.

The entire operation takes the parts directly from polishing and feeds direct to the plating machine, the entire cleaning operation being timed to fit in with these other steps. The two hot rinses are hooked in sequence, thus effecting a further operating saving. Conveyor can also be built with flight bars for baskets and individual pieces, or with a mesh belt for any type of parts in bulk or individual pieces.

- *The* **RIGHT** *Machine*
- *The* **PROPER** *Detergent*
- *The* **CORRECT** *Cleaning Method*

OPTIMUS
Provides them all!

An **OPTIMUS** Plan for the mechanized handling of your metal parts through washing, degreasing, rinsing and drying, can assist you in saving labor, materials and speeding up production. Submit your problems to **OPTIMUS.**

OPTIMUS EQUIPMENT COMPANY
ENGINEERS AND MANUFACTURERS
127 CHURCH STREET, MATAWAN, N. J.

STANDARD AND SPECIAL TYPES OF EQUIPMENT FROM THE SMALLEST TO THE LARGEST SIZES FOR A WIDE VARIETY OF OPERATIONS.

OPTIMUS EQUIPMENT
FOR CLEANING · RINSING · DEGREASING · PICKLING AND DRYING OF METAL PARTS

Safe on any surface

There's one metal cleaner that just doesn't fall down on the job. That's Wyandotte Metal Cleaner No. 38.* This *balanced* product can solve practically all the cleaning needs of the average plant with economy and efficiency.

Wyandotte Metal Cleaner No. 38 is all-soluble. It dissolves quickly, rinses easily and completely. It is designed to correct water conditions . . . wet rapidly . . . give long life in solution. It is inhibited to prevent corrosion of the metal being treated.

Wyandotte Metal Cleaner No. 38 is being used successfully for electro-cleaning of ferrous metals, as well as copper and brass. It is a proven reverse current cleaner for zinc-base die-castings. It is giving satisfaction when used in electro-cleaning baths on hand-operated, semi- and full-automatic line . . . in still-cleaning solutions . . . in tumble barrel equipment . . . in pressure spray and rotary type metal parts washing machines.

Let your Wyandotte Representative tell you more about the advantages of Wyandotte Metal Cleaner No. 38. He's always at your service.

*TEMPORARILY IN SHORT SUPPLY

Wyandotte
REG. U. S. PAT. OFF.

WYANDOTTE CHEMICALS CORPORATION • WYANDOTTE, MICHIGAN

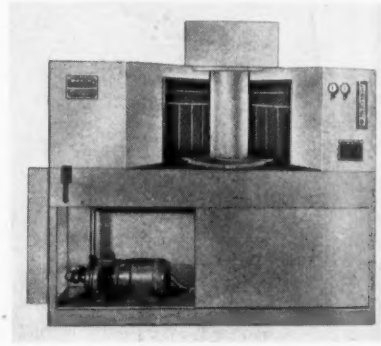
SERVICE REPRESENTATIVES IN 88 CITIES

range are now available, according to the Hanson-Van Winkle-Munning Co.

The larger plants cover equipment for cyanide copper, nickel, gold and silver plating. A 1500 ampere 6 volt motor-generator set is included, together with tanks, burnishing barrel equipment, polishing and buffing lathe equipment, tank rheostats and miscellaneous supplies. Another complete unit in the larger class consists of copper, nickel, brass, silver and chromium plating equipment. Here a 500 ampere 6 volt generator is included with tank rheostats, tanks, filter, temperature controls and lathe.

The smaller plating plant includes copper, nickel and chrome plating equipment with a 500 ampere 6 volt generator, rheostats and tanks, and other necessary equipment.

For further information write Hanson-Van Winkle-Munning Co., Dept. MF, Matawan, N. J.



Turn-Table Washing Machine

Consistent with their plans to furnish industry with a complete line of metal cleaning equipment, Mabor Co. has produced a turn-table type washer, which both rinses and dries average sized parts in baskets, trays, or individually.

This unit requires one operator to load and unload the parts for cleaning. In addition, the Turn-Table Washer is claimed to be completely self-contained, compact, efficient, and to require little floor space in which to achieve substantial production at an average of sixty baskets per hour. Basket dimensions—12″ x 12″, 16″ x 16″, or 20″ x 20″, with load capacity of 1,800, 2,500, or 3,000 pounds, according to size of machine. The machine is available in three standard sizes and may also be had with special modifications for difficult and unusual problems, where centering of parts is

essential. It may be heated by steam, gas, oil or electricity.

For additional information, costs, engineering data, etc., write to the Arbor Co., Dept. MF, Clark Township, Rahway, N. J.

Variable Speed Buffing Lathe

Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich., announce a new addition to their line of polishing and buffing lathes. It is known as the Model "VROL," a 3 hp variable speed polishing and buffing lathe with a speed range of 1,500 to 3,000 rpm. This is accomplished by turning the hand operated dial. The spindle overhangs 8" to permit handling of bulky parts. Motor is mounted in the base with "V" belt drive.

The firm also announces a new polishing machinery catalog, No. 55, which carries specifications covering their complete line of polishing and buffing machinery as well as the new variable speed lathe.

Corrosion Resistant Coating and Cement

Nukemite, a synthetic resin coating developed over the war years, is now available for general use in the plating industry. Properly applied, it quickly air dries to form a durable, leak proof film of strong adhesion on wood, concrete or metallic surfaces, it is claimed. It is said to be immune to high concentrations of commercial acids, alkalies, salt solutions and practically all solvents and is particularly suited in liquid form for protecting structural work near plating and pickling installations, machinery, floors, plating rack supports, etc.

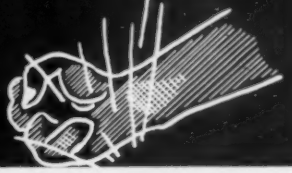
The material is also available in sheet form and in this state is used as an impervious protective membrane lining for plating tanks. It will not deteriorate or blister under maintained operating temperatures up to 170 degrees F., according to the manufacturer.

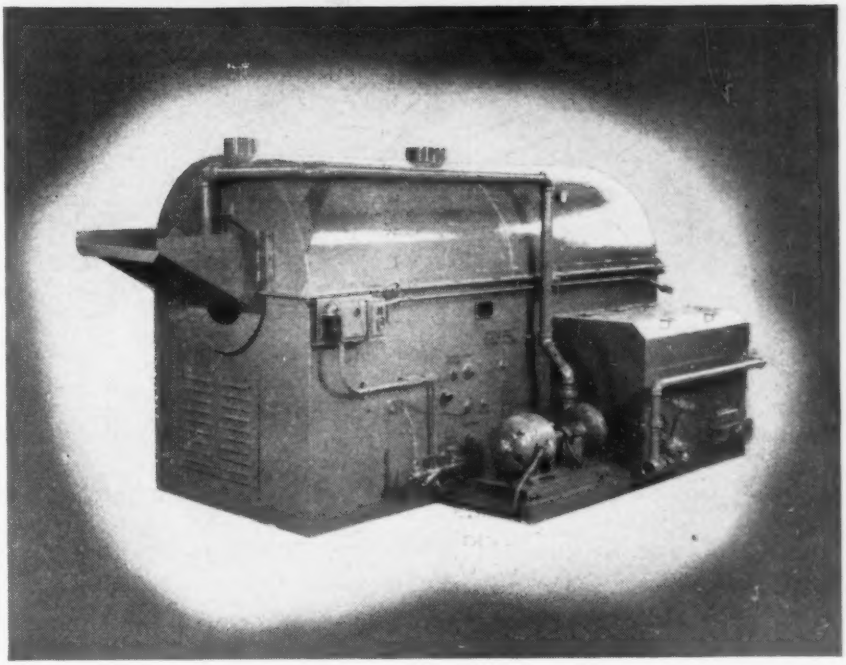
Currently, it is available in red, grey, black and white colors.

Nukem cement is a chemically setting material having exceptional compressive and tensile strength and being particularly noted for its immunity to concentrations of practically all acids (chromic and nitric excepted), alkalies or salt solutions, it is claimed.

The primary use of this material is

THE WASHER THAT had TO BE GOOD





Metal fabricators demanded a metal parts washer for stampings, castings, forgings, and small machined parts, capable of keeping pace with production.

That's why the DETREX WD ROTARY DRUM WASHER was built. Extensive field tests have proven that every development incorporated in its design has scored high with industry. Just try these for size:

1. ***Economical cleaning*—wetting, flushing in *one* cycle; hot or cold air dryoff.**
2. ***Hopper fed*—adaptable for *either* hand operation or conveyor tie-in.**
3. ***Ample capacity*—large cylindrical drum cleans production of *one department or several*.**
4. ***Steam- or gas-heated*—flexible for all plants.**
5. ***Adaptable*—ideal for emulsions or alkalies.**
6. ***Prompt delivery*—call a Detrex representative today or write direct to the address below.**

E-148

DETREX Corporation
DETROIT 32, MICHIGAN

Amineo-Brenner
MAGNE-GAGE
Determines Whether
Your Coatings Are
TOO THIN
TOO THICK
NON-UNIFORM

With the Magne-Gage a measurement can be made in less than one minute, and extensive training is not required to operate the instrument successfully. Whether you wish to measure non-magnetic coatings on magnetic base metals, magnetic coatings on non-magnetic base metals, or nickel coatings on iron or steel; it will be worth your while to . . .

Write for Bulletin MF-2125

Portable . . . Simple

Since the Magne-Gage weighs only 8 lbs. and measures only 5x9x9 in., it is readily portable.

It is self-contained . . . no electrical circuits or apparatus are involved . . . no batteries to renew.

FILMETER

Measures the thickness of non-conducting coatings on non-magnetic base metals, also anodized coatings on magnesium, aluminum, and aluminum alloys. Measurements made electrically without destroying the coating being measured.

Write for Bulletin MF-2139

AMINCO AMERICAN INSTRUMENT CO.
Scientific Instruments
8030 GEORGIA AVENUE SILVER SPRING, MARYLAND

as a jointing compound for brick constructions (such as pickling tanks and floors) where strong acids or alkalies present a corrosion problem.

The cement will withstand operating temperatures up to 350 degrees F. and thus is excellent for use where "high speed" cleaning operations are employed, according to the manufacturer.

For further information, write Nukem Products Corp., Dept. MF, Buffalo, N. Y.

Plastic Rack Coating

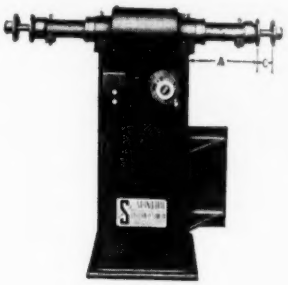
An odorless, non-inflammable plastic rack coating which can be applied to any plating plant without special precautions is announced by *Peninsular Chemical Products Co.*, Dept. MF, Van Dyke, Mich.

Known as Pen-Kote 590, this material consists of an aqueous dispersion of Saran plastic and contains no organic solvents. It is said to be tough, flexible and highly resistant to all plating and cleaning solutions, including chlorinated degreasing solvents. It is applied by hand dipping and dries in less than an hour at room temperature, giving complete protection in 24 hours. Because it is an aqueous dispersion rather than a solution, it is exceptionally free-flowing, draining rapidly without forming webs or strands to be trimmed off after dipping.

This new material is claimed to have had months of service in plating plants of all types and is now available nationally. Platers may send a sample rack to Peninsular Chemical Products Co. to be given a free trial coating and returned for testing in their own plants.

Buffing and Polishing Machines

The Standard Electrical Tool Co., Dept. MF, 2503 River Road, Cincinnati 4, Ohio, now have a redesigned 2 hp and 3 hp infinitely variable speed buffing and polishing machine.



While the illustration is of the enclosed spindle construction with four ball bearings, sight feed oil gauge on each bearing housing and shaft lock, this machine is also available with exposed or open spindle.

The enclosed ball bearing motor is on an adjustable base attached to the back of the pedestal, with power transmitted to spindle through belted drive.

Any spindle speed between 1,500 and 3,000 r.p.m. is available by turning the Speedial control. Each change in spindle speed is immediately recorded on the dial.

The drive is properly guarded and equipment includes a push button safety starter having overload protection.

There are nine models, ranging from 1 hp. up to 15 hp.

Polishing Wheel Cement

The Hanson-Van Winkle-Munning Co., Dept. MF, Matawan, N. J., announces a new grain cement and thinner, a welcome addition to plating supplies in these days of glue shortages. This material is an improved adhesive for polishing wheels which is said to overcome the deficiencies of organic glues. It has been used in the field for a number of months with complete success, it is claimed.

Special pointers on the use of these

materials are given as follows:

Mix thoroughly before using.

Blend and work grain into wheel.

Be sure wheels are dry.

Make up several wheels with different mixtures to find the correct one for the job.

Full and detailed directions are available on request by writing to the firm as above.

Manufacturers' Literature

Motor-Generator Sets

Bulletin B-208 describing the equipment made by *The Electric Products Co.*, has recently been released. The firm is a specialty manufacturer of high-current, low-voltage motor-generators.

Illustrated are several electrolytic motor-generators of various current and voltage ranges. Control panels for semi-automatic control applications are also shown. Diverter-pole motor-generators, frequency changers, and special motors and generators of various types are also pictured and described. Descriptive material on each type is also listed, as well as general information on the equipment.

To secure a copy of this bulletin, write The Electric Products Co., Dept. MF, 1726 Clarkstone Road, Cleveland 12, Ohio.

Sprayed Metal Information

The January issue of the *Metco News*, published quarterly by *Metallizing Engineering Co., Inc.*, Long Island City, N. Y., describes the varied uses ("from pump liners to push buttons") that a major oil refinery has made of metallizing over a 12-year period; also, the metallizing of plywood to form electrodes of a table that tests rubber blankets at 10,000 volts; copper metallizing of cast iron core boxes to eliminate core oil trouble in making castings; solving the problem of protecting the welded seam in steel barrels and drums through production metallizing; protecting aircraft engines against atmospheric corrosion and salt spray; and a "Technical Talk" on a method for improving the adhesion of sprayed metal to blasted surfaces.

Corrosion-Resisting Equipment

A new 20-page general bulletin re-

blessing in disguise

YES—BLESSED WAS THE SHORTAGE *which proved belts* SUPERIOR!

PRODUCTION RECORDS PROVE *Michigan Abrasive* Belts

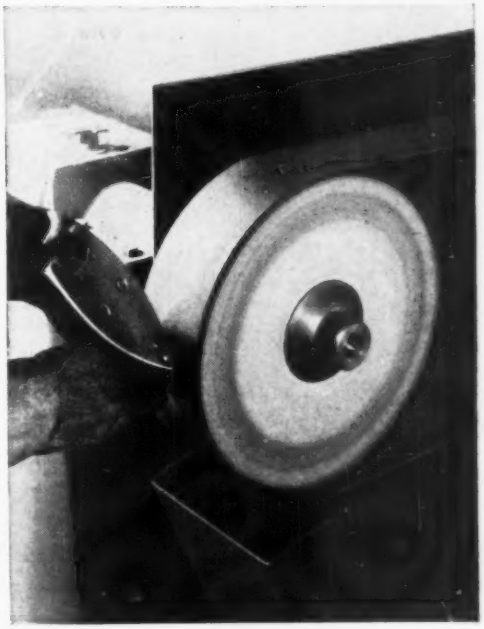
with Backstand Idlers will more than merely DUPLICATE 90% of the work you now do with set-up wheels! Belts will do it with

QUALITY! SPEED! ECONOMY!

Here's Why:

1. Grain changes, when necessary, made four times faster...
2. Inventory of wheels, glue, cement and various grains eliminated...
3. Number of grain sizes required per job reduced...
4. Specialized skill for gluing up wheels eliminated...
5. Messing with glue, cement and odors removed from your shop to ours...
6. Quality of work improved with less operator fatigue, greater speed...
7. Idlers as well as belts, are in *ample* supply...

Write immediately for new bulletins describing Michigan Abrasive Belts and Michigan Lapping Compounds. Our General Catalog Price List on our complete line of abrasives is yours for the asking. *Dealers will be especially interested in the details of our sales plan.*



Belt polishing of electric irons before plating. (Dust Collector conduit removed for clarity.)

Michigan Abrasive Co.

Manufacturers of COATED ABRASIVES and LAPPING COMPOUNDS

1111 Bellevue Street — Detroit 7, Michigan

ONE SOLVENT...

for all Metals or Combination of Metals

NEW SCIENTIFICALLY IMPROVED

BLACOSOLV

FOR SOLVENT VAPOR DEGREASERS

No need to use a special solvent for cleaning a combination of metals—BLACOSOLV degreases them all . . . Safely . . . Quickly . . . Economically.

BLACOSOLV is the most highly stabilized solvent . . . ideal for aluminum, magnesium, brass, copper, steel, etc., either individually or in combination. It is non-inflammable—is positively safe—will not stain or dull even the most highly polished surfaces . . . the one price solvent for all metal degreasing jobs. Its economy is increased in the uninterrupted service it affords you in your production.

Write today for FREE BOOKLET ON Degreasers and application with Blacosolv the all purpose degreasing solvent.

G. S. BLAKESLEE & CO.

BLACOSOLV DEGREASERS AND SOLVENT

NIAGARA METAL PARTS WASHERS

G. S. BLAKESLEE CO., CHICAGO 50, ILLINOIS
NEW YORK, N. Y. TORONTO, ONT.

cently published by the *Duriron Co., Inc.*, Dept. MF, Dayton 1, Ohio, gives a general description of each type of corrosion-resisting equipment provided by the company. This new general catalog supersedes all general catalogs published by the company and includes information on new alloys and equipment recently developed. It also contains a list of processes in various industries in which *Durco* equipment handles chemical corrosives.

The bulletin describes the production facilities of the company and explains the composition and applications of *Duriron*, *Durichlor*, *Durimet* and *Chlorimet*, the main corrosion-resisting alloys of which the company's products are made.

The bulletin also tells what alloys each piece of equipment is available in; gives sizes and capacities and tells the reader what bulletin to request for complete details on any particular piece of equipment.

This general catalog is available without obligation from The Duriron Co., Inc. Ask for *General Catalog H.*

Business Items

Gray Joins Pennsalt Advertising Department

Bryce Gray, former first lieutenant in the United States Army Air Force, has joined the Advertising Department of the *Pennsylvania Salt Manufacturing Co.*, announced *Sydney L. W. Lea*, Pennsalt advertising manager.

Mr. Gray, former city clerk of the Borough of Longport, N. J., is a graduate of Rutgers University and the Perkiomen Preparatory School. He is married and is the father of one son.

Wyandotte Chemicals Adds Two Ohio Representatives

Charles N. Chalfont and *John E. McCarthy* are recent additions to the Industrial Department service staff of *Wyandotte Chemicals Corp.* Both were given practical training courses in several Wyandotte territories before being given their Ohio assignments; Mr. Chalfont to Dayton and Mr. McCarthy to Columbus.

For 13 years Mr. Chalfont was a member of the laboratory staff of *Copperweld Steel Co.*, and for the past four years was the Detroit service representative of *G. Whitfield Richards*, manufacturer of cutting, drawing and grinding lubricants. His chemical and metallurgical studies at Carnegie Tech and University of Pittsburgh, and his memberships in the American Society

Charles N. Chalfont

John E. McCarthy

of Metals and Society of Lubrication Engineers will be of practical value to Mr. Chalfont in his service work. He will assist *Tom McHugh*, who is well known in the Southern Ohio metal finishing industry.

Mr. McCarthy is a resident of Columbus and attended Ohio State University. For four years he was head of the Engineering Materials Laboratory of *Curtiss-Wright Corp.* and directed the activities of the chemical, metallurgical and physical sections. His previous experience plus his "refresher" training makes him well fitted for servicing the metal finishing industry. He will operate under the direction of the Cleveland office where *Earle J. Esner* is the Industrial Department representative.

Optimus Moves to New Plant

Optimus Equipment Co., engineers and manufacturers of metal washing and drying equipment, and *Optimus Detergents Co.*, manufacturers of industrial cleaning materials, both of Matawan, N. J., are occupying their new enlarged plant, located there.

Since their inception two years ago, both companies have been located in the plant of the *Hanson-Van Winkle-Munning Co.* Recently, the buildings of the former *Matawan Tile Co.* have been purchased for the purpose of providing the two Optimus activities with increased space and manufacturing facilities.

With the new plant in operation, improved streamlined production layouts for the manufacture of equipment, including a new line of metal degreasers, has been made possible. Operating with a considerable backlog of orders, the company will now be enabled to speed up its production schedule.

The entire manufacturing facilities of the detergents firm will be housed in the new plant, a separate building being devoted to it. All told, the new plant consists of 11 buildings, 6 of which will be utilized by the Optimus activities, the balance to be occupied to a large extent by the parent organization, Hanson-Van Winkle-Munning Co.

All office, sales, laboratory, design and manufacturing personnel will be located at the new plant, which will be under the direction of *Allen T. Baldwin*, general manager of the two Optimus companies.

Wirtz Passes Away

Friends of *The Atlas Mineral Products Co.* of Mertztown, Pa., will learn with sorrow of the passing on December 16th, of *Arthur F. Wirtz*, secretary-treasurer of the firm. Mr. Wirtz, who was forty-six, died suddenly of a heart ailment. He had been with the company since 1921 and had been an officer since 1926.

Oscar E. Nordstrom Retires

Oscar E. Nordstrom who has been Chicago District Manager of the

9 Months of Service in Copper, Nickel, Chromium — and

STILL NO SIGNS OF BREAKDOWN!

UNICHROME
RACK COATING 203
can take it in strong doses!

No breaks, no blisters, no peeling—Unichrome Coating 203 was still in good shape after nine solid months in copper, nickel and chromium plating baths, and the usual cleaning cycles! This report of extra service from one plater bears out what so many others have also discovered—that Coating 203 saves time and money.

No wonder Unichrome rack coatings are such favorites with metal finishers. Specially developed from synthetic resins, Coating 203 is flexible as well as tough and adherent—resists not only the hot, strong solutions, but shop handling too. It's easy to work with. Simply dip, brush or spray, and hang up to dry. Let it prove to your own satisfaction how you too can get outstanding service. Write your nearest Unichrome office for details.

For Force Drying—
UNICHROME RACK COATING 202
It provides all of the chemical resistance and mechanical strength of Coating 203, in addition to extra adhesion from force drying.

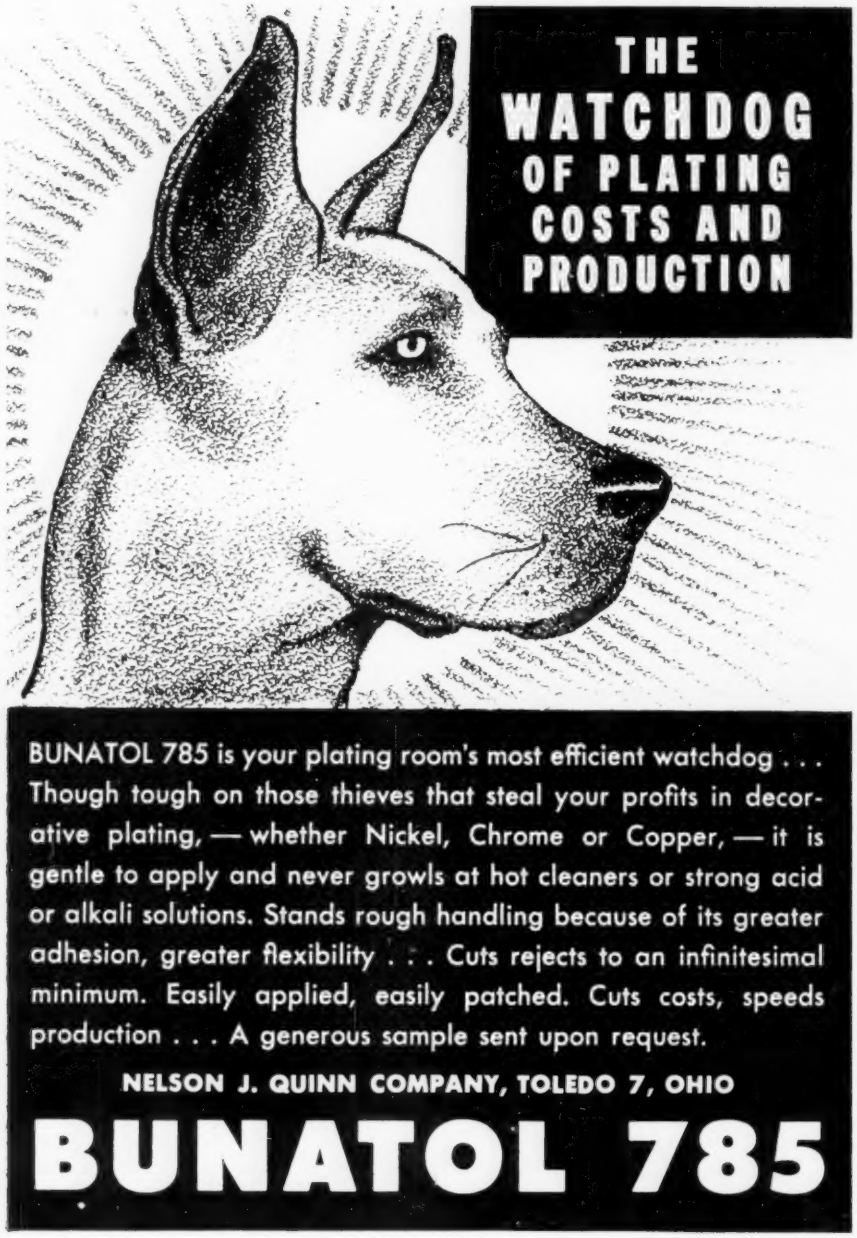
UNICHROME

PROCESSES AND MATERIALS
FOR SURFACES THAT SURVIVE

Chromium Plating · Porous Chromium · Unichrome* Copper · Unichrome Lacquers · Ucilon* Protective Coatings · Unichrome Stop-Off Lacquers and Compounds · Unichrome Dips · Unichrome Rack Coatings · Anozinc* Compounds · Unichrome Strip

*Trade Mark Reg. U.S. Pat. Off.

UNITED CHROMIUM, INCORPORATED
51 E. 42nd St., New York 17, N. Y.
Detroit 7, Mich. • Waterbury 90, Conn. • Chicago 4, Ill. • Dayton 2, Ohio • Los Angeles 11, Cal.


THE
WATCHDOG
OF PLATING
COSTS AND
PRODUCTION
BUNATOL 785 is your plating room's most efficient watchdog . . . Though tough on those thieves that steal your profits in decorative plating, — whether Nickel, Chrome or Copper, — it is gentle to apply and never growls at hot cleaners or strong acid or alkali solutions. Stands rough handling because of its greater adhesion, greater flexibility . . . Cuts rejects to an infinitesimal minimum. Easily applied, easily patched. Cuts costs, speeds production . . . A generous sample sent upon request.
NELSON J. QUINN COMPANY, TOLEDO 7, OHIO
BUNATOL 785

Grinding Machine Division at *Norton Company*, Worcester, Mass., for 20 years, retired from active duty on January 1 but will continue to act as a consultant. He is succeeded by *Robert D. Lawson*, formerly sales representative for the Norton Grinding Machine Division in northern New England. Mr. Lawson has been with the company for over 27 years. Mr. Nordstrom has been with the company since October 1904 and is well known by users of grinding and lapping machines in the midwest because of his long service there.

B. Harold Lewis succeeds Mr. Lawson as representative for the entire New England area except for western Massachusetts and Connecticut. Mr. Lewis has been in sales work with the Grinding Machine Division for over 30 years. His headquarters will be at the Worcester plant.

Electric Products Names Udylite as Distributor

Gordon J. Berry, vice-president of *The Electric Products Co.*, Cleveland, Ohio, announces that effective December 1, 1946, the *Udylite Corp.* of Detroit was appointed a distributor of E. P. electrolytic motor generators. Udylite, with its nation-wide organization of sales representatives throughout the industrial centers of the country is in constant contact with all elements of the plating and finishing industry.

Baughn Chemical Elects Lyman

The *Baughn Chemical Products Co., Inc.*, announce the election of *Thomas M. Lyman* to the board of directors and secretary-treasurer.

The firm is the exclusive processor of *Crystal Tack Rags*, nationally distributed direct through large paint manufacturers, dealers and jobbers. Their product, which is stated to stay soft and tacky indefinitely, and said to have many uses on paint production line products and auto refinish shops to remove dirt and sand particles.

A plan to increase production facilities considerably is under way by

Thomas M. Lyman

improving methods for impregnating the tack rags.

Mr. Lyman, recently released from the army after more than five years' service, is a graduate of the University of Illinois and was formerly connected with the Chicago office of *S. D. Leidesdorf & Co.*, certified public accountants; was with *McKesson & Robbins, Inc.*, of New York, at the time of his induction in June, 1941.

Mathieson Appoints Two Vice-Presidents

The Board of Directors of *The Mathieson Alkali Works* has elected *D. W. Drummond* and *Arthur T. Bennett* as vice-presidents, it was announced by *George W. Dolan*, president. Mr. Drummond's new title is vice-president general manager of sales and Mr. Bennett's, vice-president general manager of operations.

Mr. Drummond joined the Mathieson organization in 1938 as assistant

D. W. Drummond

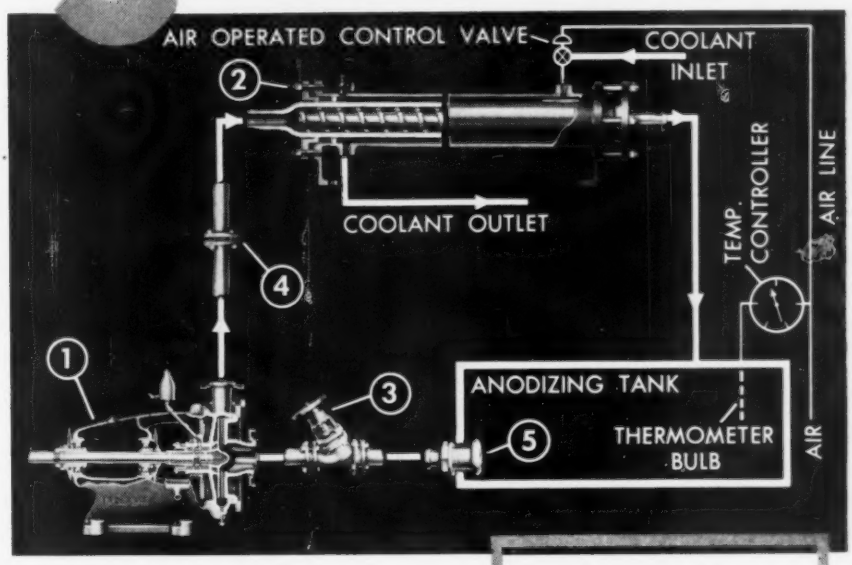
sales manager of the carbon dioxide division; a year later he was named sales manager of the division, then assistant general manager of sales of the company, and, at the time of his election to his new post, was general manager of sales. A native of Philadelphia, Mr. Drummond attended the University of Pennsylvania from which he graduated in 1926.

Mr. Bennett was born in Saltville, Va., where one of the Mathieson plants is located. He obtained his education at Cass Technical School in Detroit, Mich., Detroit University and Syracuse University. In 1933, he joined Mathieson as a technical assistant. Subsequently, he served as superintendent of the soda ash department at the com-

Arthur T. Bennett

pany's Lake Charles, La., plant, as assistant manager at the Saltville plant, assistant director of operations in New York, and, in 1943, became general manager of operations.

5 REASONS WHY THIS ANODIZING SET-UP STANDS UP AGAINST CORROSION



Five kinds of Durco equipment defend your anodizing installation against corrosive attack. This equipment is self-protected by the alloy of which each unit is made, Duriron.

Duriron is a Durco iron alloy containing approximately 14.5% silicon. This element gives it an extremely high resistance to sulfuric and chromic acid and to a wide range of other corrosives. Duriron's corrosion-defeating ability is permanent and uniform throughout.

Durco Adv. 26-GM

DURCO EQUIPMENT FOR ANODIZING

1. MODEL 40 DURCOPUMPS — With capacities up to 2000 GPM for heads up to 230 ft.
2. DURCO NO. 4 HEAT EXCHANGER —4C cooler, capacity 45,000 to 90,000 BTU per hour. Multiple units in either series or parallel arrangement, if additional capacity is required.
3. DURCO Y VALVES—Full opening with nearly straight flow.
4. DURCO SPLIT FLANGED PIPE AND FITTINGS—in sizes from 1" to 8" I.D. Larger diameters made to order.
5. DURCO TANK OUTLETS—For either thin or thick wall tanks and for flanged or lead pipe connections.

For complete information on all of the above types of Durco equipment ask for Bulletin Folder R.

DURCO CORROSION RESISTING ALLOYS & EQUIPMENT

THE DURIRON COMPANY, Inc.
DAYTON 1, OHIO, U.S.A.

Pennsalt Names Abbott

Frederick C. Abbott has been appointed Manager of Labor and Personnel Relations for the *Pennsylvania Salt Manufacturing Co.*, it was announced by *Y. F. Hardcastle*, vice-president in charge of manufacturing.

Before his new appointment, Mr. Abbott was assistant production manager. Previously, he was manager of the New Products Division. He joined Pennsalt in 1943, coming there from the *Ozark Chemical Co.*

Mr. Abbott is a graduate of the University of Arkansas. He is a member of the *American Chemical Society*, the *American Institute of Chemical Engineers* and *Franklin Institute* of Philadelphia.

Osborn Export Manager Plans England Visit

Ward Dougherty, Export Manager of the Machine Division of *The Osborn Manufacturing Co.*, will leave shortly for London, England, where he will study the latest developments in England's post war heavy industries as they relate to the need for American built foundry equipment and to familiarize the manufacturers with Osborn's latest contributions to machine moulding techniques.

Mr. Dougherty, who recently returned from a five-weeks' visit in Mexico, plans to remain in England about a month.

American Electro-Platers' Society

COMING BANQUETS

BUFFALO, NEW YORK

MARKEEN HOTEL

SATURDAY—MARCH 22, 1947

Educational Session 2:30 P.M. Dinner 7:30 P.M.

"Date-line Tomorrow" and "Finishing of Aluminum" illustrated with movies will be in charge of Mr. Ralph E. Pettit of the Aluminum Company of America at the afternoon session.

For Reservations write Mr. Charles W. Logan, General Chairman, 48 Nassau Ave., Kenmore, N. Y.

BOSTON

HOTEL STATLER

SATURDAY—MARCH 22, 1947

Educational Sessions 1:30 P. M. Banquet in Evening

SPEAKERS

W. M. Phillips M. M. Beckwith W. H. Jackson

LOS ANGELES

LOS ANGELES BREAKFAST CLUB

SATURDAY—MARCH 22, 1947

Morning, Afternoon Business Sessions—Evening Banquet

FOURTH ANNUAL REGIONAL MEETING

CINCINNATI, COLUMBUS, DAYTON, ST. JOSEPH'S VALLEY and INDIANAPOLIS BRANCHES

INDIANAPOLIS ATHLETIC CLUB—INDIANAPOLIS

SATURDAY—MARCH 29th, 1947

Dinner—Dance 6::30 P.M.
Dress Optional

Price
$5.00 each

For Reservations write Walter R. Binai, 26 N. Sheridan—Indianapolis, Indiana, not later than March 15th. Check must accompany reservation.

Brown Co. Promotes Schmitt, Pyle and Roat

Henry M. Schmitt has been named chemical industry manager of the *Brown Instrument Co.*, Philadelphia. *O. B. Pyle* has been made industrial manager of the Philadelphia branch and *A. W. Roat* is now industrial manager of the St. Louis branch of the industrial division of *Minneapolis-Honeywell Regulator Co.*

The sales executive staff changes were made known by *W. H. Steinkamp*, field sales manager for Brown. At the same time Mr. Steinkamp announced that *I. K. Farley* has been placed in charge of the major petroleum accounts in the Philadelphia area and *Harry D. Ruch* will also work out of the industrial sales division at Philadelphia.

Mr. Schmitt has been with the Brown company for the past 22 years. His successor, Mr. Pyle, has been with Brown for 18 years and is the holder of high sales records.

Roat succeeds to the position held in the recent past by *V. H. Hiermeier* who has been transferred to the Honeywell international division. He will probably be assigned to a foreign post. Roat has been with the company nine years during which time he has served in Pittsburgh, Cleveland and Philadelphia.

Seppala Appointed by Michigan Chrome

Les Seppala was recently appointed sales representative for the *Michigan Chrome and Chemical Co.*, 6340 East Jefferson Ave., Detroit, Mich. His activities cover Ohio, western New York, western Pennsylvania, Kentucky and West Virginia, with offices at 1123 Fidelity Building, 1940 E. Sixth Street, Cleveland 14, Ohio.

Mr. Seppala flew with the AAF five years, and gained the rank of Lieutenant Colonel. He was a combat pilot in the Eastern Theater of Operations and was shot down while strafing in a Mustang over Germany, spending three months as a prisoner of war at Nuernberg and Mooseberg.

Mr. Seppala received his B.A. at Wayne University, Detroit, Mich., in 1939, and his master's degree in 1940.

Les Seppala

Before joining the Michigan Chrome and Chemical organization he served as Veterans Counselor for Wayne University. Mr. Seppala is actively engaged in promoting the sale of the company's products in domestic and foreign markets.

Platers Technical Service Opens Chicago Laboratory

Platers Technical Service, Inc., of New York has opened a branch laboratory at 509 S. Wabash Ave., Chicago 5, Ill., in charge of *Charles Geldzahler*, branch supervisor. The new laboratory, located in the Loop, offers a complete service for the metal finishing industry including deposit and solution analysis, process development and plant design.

Charles Geldzahler

Mr. Geldzahler, a graduate chemist, is thoroughly familiar with metal finishing problems. Before coming to Platers Technical Service, he was associated with *A. Robinson & Son*, New York, doing research on gold plating solutions. During the war, he worked in the chemical laboratory of *Philco Corp.* on all types of specification plating and paint finishes.

Eaton-Clark Holds Finishing Clinic

The annual Sales Clinic of *Eaton-Clark Co.*, Detroit, Windsor and Toronto, was held in Detroit January 7th to 10th, with twenty-seven in attendance at the opening session. Among the out-of-town sales representatives in attendance were:

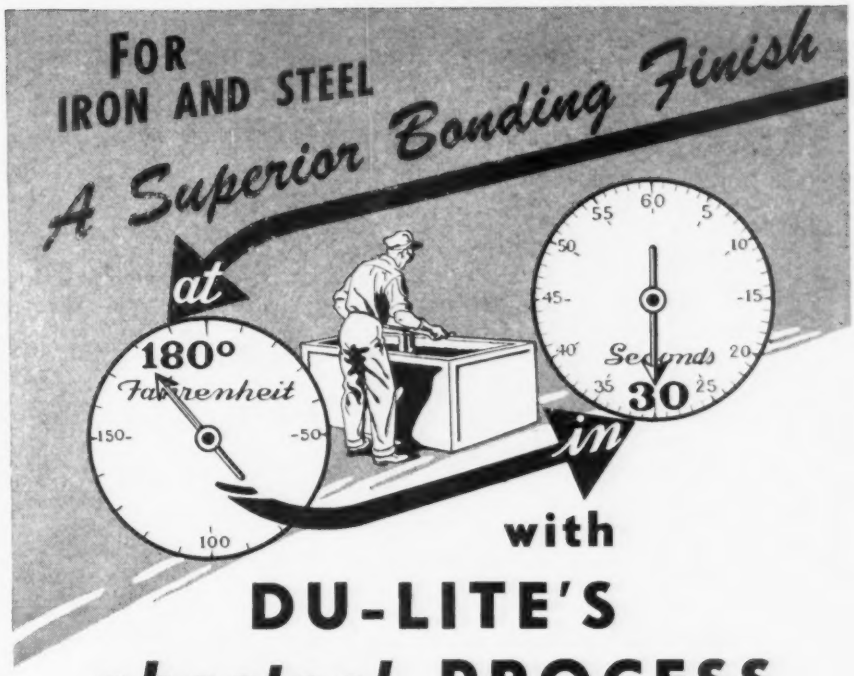
Frederick J. Rowe, of Sodus, N. Y.; Melvin R. Espeland, of Dallas, Tex.; Earl S. Bullock, of Pasadena, Cal.; Wilmar W. Kaufmann, of Saginaw, Mich.; John E. Grout, of Scarsdale, N. Y.; H. Kenneth Robinson and Ernest G. Bainbridge, of Toronto, Ont.; Howard G. Oster, of Windsor, Ont.

The first two days were devoted to a Clinic, after which there was a two day conference at the University Club, at which such subjects were discussed as "Metal Finishing," "Alkali Cleaning of Metals," "Bright Nickel Process in Electroplating," "Refrigeration Gases," "Coloring and Anodizing of Aluminum," "Dry Cleaning," etc.

At luncheon at the University Club January 9th, *Mr. Earl F. Clark*, of *The Cowles Detergent Co.*, addressed the group on "Silicates and Their Uses." At luncheon, January 10th, *Mr. Melvin E. Clark*, of the *Wyandotte Chemicals Corp.*, spoke on "Chemical Market Research," and *Mr. Thomas Simpson*, of the Wyandotte Chemicals Corp. spoke on the subject of "Chemical Knowledge Required in Present Day Selling."

Friday evening, January 10th, the Clinic was concluded with a dinner at the University Club, attended by twenty-eight members of the Management and Sales Force. The speakers were *Rufus W. Clark*, chairman of the Board; *Berrien Eaton*, president; *Richard C. Hedke*, vice president and managing director. *Wilmar W. Kaufmann* was toastmaster.

The company, founded in the year 1838 by *Theo. H. Eaton*, is now commencing its 110th year in business, and is recognized as the oldest industrial firm in Michigan.



DU-LITE'S
***phosteel* PROCESS**

New developments and recent refinements of the DU-LITE Phosteel Process have now made it possible to impose an excellent bonding finish on all shapes of iron and steel in 30 seconds at a Fahrenheit temperature of 180°. The new Phosteel retains its previous valued advantages:

LOWER COST — *To Buy and Use*
BALANCED BATH — *Simply Operated*
AVAILABLE—*For Immediate Installation*

DU-LITE CHEMICAL CORP.
MIDDLETOWN, CONNECTICUT

PATENTS

(*Continued from page* 88)

Detergent Material

U. S. Pat. 2,412,945. *F. C. Bersworth, Verona, N. J., Dec.* 24, 1946

A product of manufacture consisting of the reaction product of an aliphatic polyhydroxy alcohol and an alkali metal salt of a lower alkyl amino polyacetic acid, said reaction product being formed by heating the said salt in aqueous solution with at least 15% by weight of said alcohol to temperatures within the range 115-200° C. for an extended time interval effective to vaporize the major portion of the water

SLASH YOUR LABOR COSTS —BOOST YOUR OUTPUT With This PROVEN ALMCO PRODUCTION TEAM!

This "team" of related Almco units saves time and effort at every point—provides *unequaled output* with *tremendous labor savings* in precision deburring and finishing. Note these outstanding advantages:

1 ALMCO 4-SPEED TUMBLING BARREL. 11 sizes; welded steel, plain or neoprene lined. Has light-weight doors, clamped by lever; extra-wide openings; hydraulic brake; quick speed change.

2 PORTABLE POWER SCREEN. Fits under barrel. Quickly separates load on discharge. Screen size readily changed.

3 MOBILE ELECTRIC HOIST. For lifting and transporting abrasive in hoist pan. Eliminates hand loading of barrel. Rolls freely on ball bearing casters.

4 MOBILE HOIST PAN. Fits under screen and barrel; moves on casters. Covered snout facilities pouring. Drain-off provided.

5 TWO-COMPARTMENT STORAGE HOPPER (not shown). Gives quick discharge of abrasive into hoist pan through non-sticking lever-operated valves. Sloping bottom assures free flow.

Write today for FULL DETAILS. No obligation, of course.

DISTRIBUTORS: *The above features, plus many others, make this a worthwhile line to handle. We invite your inquiries.*

ALMCO INCORPORATED

ALBERT LEA • MINNESOTA

(*Continued from preceding page*)

therefrom, said reaction product thereby obtained being characterized by being highly soluble in water, by being non-reactive with salts and electrolytes present in the water to form insoluble compounds therewith, by being a strong detergent in aqueous solutions, and by being miscible in all proportions up to equal amounts by weight with alkali metal fatty acid soap compounds without detriment to the bar, flake and powder form.

Vacuum Deposition

U. S. Pat. 2,413,606. *W. H. Colbert and A. R. Weinrich, assignors to Libbey-Owens-Ford Glass Co., Dec.* 31, 1946

The method of making mirrors by the deposition of a metal on a polished support material, comprising evaporating a metal from a filament made of a metal selected from the group consisting of tungsten, tantalum, molybdenum and columbium wherein the metal to be evaporated is heated on such filament as an alloy with beryllium which causes the metal desired to be evaporated to wet, to adhere to, and to spread out over the filament surfaces and by the continued application of heat, to evaporate, and depositing a coating thereof on said polished support material.

Evaporation Coatings

U. S. Pat. 2,413,605. *W. H. Colbert and A. R. Weinrich, assignors to Libbey-Owens-Ford Glass Co., Dec.* 31, 1946

The method of producing coatings by the evaporation of a metal melting below 1900° C. from a filament selected from the group consisting of tungsten, tantalum, molybdenum and columbium which it normally does not wet or adhere to, wherein pieces of the metal are applied to the filament and heated on such filament, in which said filament has been previously alloyed with another metal selected from the group consisting of platinum, palladium, iron, nickel and cobalt, which alloyed filament causes the metal desired to be evaporated to wet, to adhere to, and to spread out over the filament surfaces, and by the continued application of heat, to evaporate and to deposit upon an article to be coated.

Letters to the Editor

The Editor
Metal Finishing
11 West 42nd Street
New York 18, N. Y., U. S. A.

Dear Sir,

The October issue of *Metal Finishing* contains, on Page 435, under the heading "Recessed Parts Drying," a question referring to the nature of "plater's compound."

From the answer, it would appear that this expression is not commonly used in the States, and it may, therefore, be of interest that in this country this term is applied, by some of the supply houses, to a neutral soap suitable for addition to the final hot water rinse.

The name is not used for alkaline cleaners.

Yours faithfully
G. S.
London, England

Editor, *Metal Finishing*
11 W. 42nd Street
New York City

Dear Sir:

Correction please! Dr. Morral in his article on water in the plating room gave as reference my paper on "Drag-In." The correct reference is "The Monthly Review," Sept. 1942, 751-770, instead of "Metal Ind." 1937, as given. Would appreciate publication of this correction in the next issue.

Sincerely yours,

JOSEPH B. KUSHNER

Metal Finishing
11 West 42 Street
New York 18, N. Y.

Gentlemen:

In a recent issue of *Metal Finishing* under Shop Problems, a question was asked relative to plating on stainless steel using Gardam or Wood solutions, and patents on these solutions.

In reply it was stated that your files did not show any patents issued to either Gardam or Wood, but that there are a number of patents issued for stainless steel plating consisting of an acid plus a metal salt, and also that the Mond Nickel Company has had a patent issued to them.

I would like to call to your attention the fact that in *Metal Industry*, November, 1925—page 451, there was published "Deposition of Metals Upon Stainless Steel" by Joseph Haas and Elmer R. Unruh. Had Haas and Unruh taken out a patent, instead of publishing the results of their research work on the plating of stainless steel, their patent would be a "basic patent," and such modifications as the addition of nickel chloride or any other metallic salt would be subterfuge.

Consequently, no patents issued on the plating of stainless steel are valid. The authors of the above mentioned article contributed it to the public, and any person wishing to plate on stainless can do so without fear of any infringements, so long as they remain within the basic tenets, namely activate the stainless steel to be electroplated cathodically in a solution of hydrochloric or sulphuric acid, without or with a metallic salt.

Very truly yours,

J. H.

CHROMIC ACID

99.75% PURE

With two complete, independent plants at Jersey City and Baltimore, and its own supply of the basic raw material Chrome Ore from company owned and operated mines, Mutual is the world's foremost manufacturer of Chromic Acid.

MUTUAL CHEMICAL CO. OF AMERICA — NEW YORK

OVER A CENTURY OF CHROMIUM CHEMICAL PROGRESS

Bichromate of Soda
Bichromate of Potash

MUTUAL CHEMICAL COMPANY OF AMERICA
270 MADISON AVENUE NEW YORK 16, N. Y.

PERMAG
puts Speed and Efficiency in Your Metal Cleaning Jobs!

These days call for bigger and better production in all types of metal parts. In the process of cleaning metals, PERMAG Compounds are the ideal cleaner for preparing the surfaces for the final finish—which must be perfect.

PERMAG Compounds are used by leading metal fabricators everywhere. Glad to send you details about PERMAG.

MAGNUSON PRODUCTS CORPORATION
Mfrs. Specialized Cleaning Compounds for Industry
Main Office: 50 Court St. BROOKLYN 2, N. Y.
In Canada: CANADIAN PERMAG Products Ltd., Montreal, Toronto

LATHES
at Long Last!
Buffing and Polishing LATHES in Stock

We have a very fair assortment of polishing and buffing lathes on hand, comprising—

Motor driven Bench Lathes
Belt driven Floor Lathes
Motor driven Floor Lathes

No great quantity of anything, but a good variety of horse powers and speeds.

Tell us what you need and we probably are in a position to offer something which would meet your requirements.

MUNNING & MUNNING, Inc.

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THE MUNNING LINE

DEPENDABLE QUALITY

Quality and Uniformity at All Times

HARRISON 4-A PRODUCTS

For cutting, cut and color, or minor finishing, our superior compounds are faster cutting, more economical, and increase production. They are thoroughly dependable for all regular requirements.

New Compounds for Either Spraying or Dipping

Cement and Thinner

Buffing Compounds

Stainless Steel Polishing Compounds

Double Header Compounds
Sizes — 150 - 180 - 220 - 240 - 320

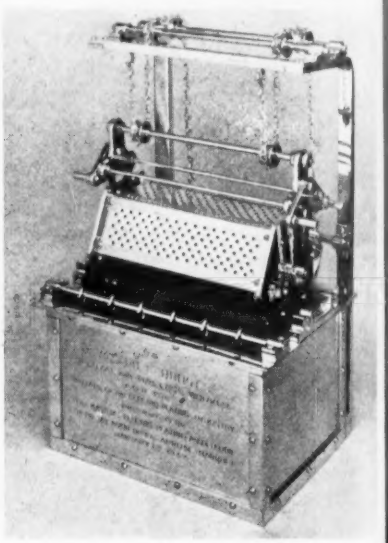
Consult us, without obligation, on your special problems. We will be glad to send samples of compounds that will meet your particular requirements. Write us to-day.

HARRISON & COMPANY—HAVERHILL, MASS.

Associations and Societies

MASTERS' ELECTROPLATING ASSOCIATION BANQUET

The annual banquet of the *Masters Electroplating Association* of New York was held on Saturday, January 18, 1947 at the Park Central Hotel, New York City. Approximately 160 people attended. The feature of the evening was a presentation of a model of a plating barrel to *Joseph F. Brust*, President of *Brust Bros.*, Brooklyn, in recognition of his loyal and tireless service to the electroplating industry.



At the same time, orchids were presented to *Mrs. Brust* and *Miss Bessie Siegel*, (Mrs. Norman S. Young) in recognition of their aid to the firm.

The model was made entirely of brass and plated all over with a heavy coating of gold and was made in the shop of one of the members, the *National Chromium Corp.*, 34 Hubert St., New York, N. Y. The gold plating was done by Edward Fascher, 473 W. Broadway, N. Y., another member of the same organization.

This presentation continued a custom which was begun before the war by the Association. In 1939 a dinner was held in honor of the late *Philip Sievering*, signalizing his 50th year of continuous business operation. Mr. Sievering was presented with a gold plated model of a plating tank. The war interrupted these celebrations, but they were resumed last year with the presentation of an engraved plaque to *Walter Plumacher* of *R. Plumacher & Sons*, 344 E. 59th St., New York City, for his services to the industry.

The model presented to Mr. Brust is an outstanding example of the electroplater's art which made it peculiarly suitable as a gift to an electroplating firm.

AMERICAN ELECTROPLATERS' SOCIETY

Indianapolis Branch

The *Cincinnati, Columbus, Dayton, St. Joseph's Valley* and *Indianapolis Branches* of the *American Electroplaters' Society* have again combined their efforts to present their fourth annual regional meeting and dinner-dance.

The day set is Saturday, March 29, 1947. In the afternoon a symposium of the problems of copper, nickel and chrome plating will be given, and in the evening the dinner-dance is scheduled to begin at 6:30 P. M.

For reservations write *Walter R. Binai*, 26 N. Sheridan, Indianapolis, Ind., not later than March 15. Check must accompany reservation.

Newark Branch

A cordial invitation is extended by the *Newark Branch* of the *A. E. S.* to members and friends to attend their annual Open Winter Educational Session. This meeting is scheduled to be held on March 7, 1947 at 7:30 P. M., at the Robert Treat Hotel, Newark, N. J.

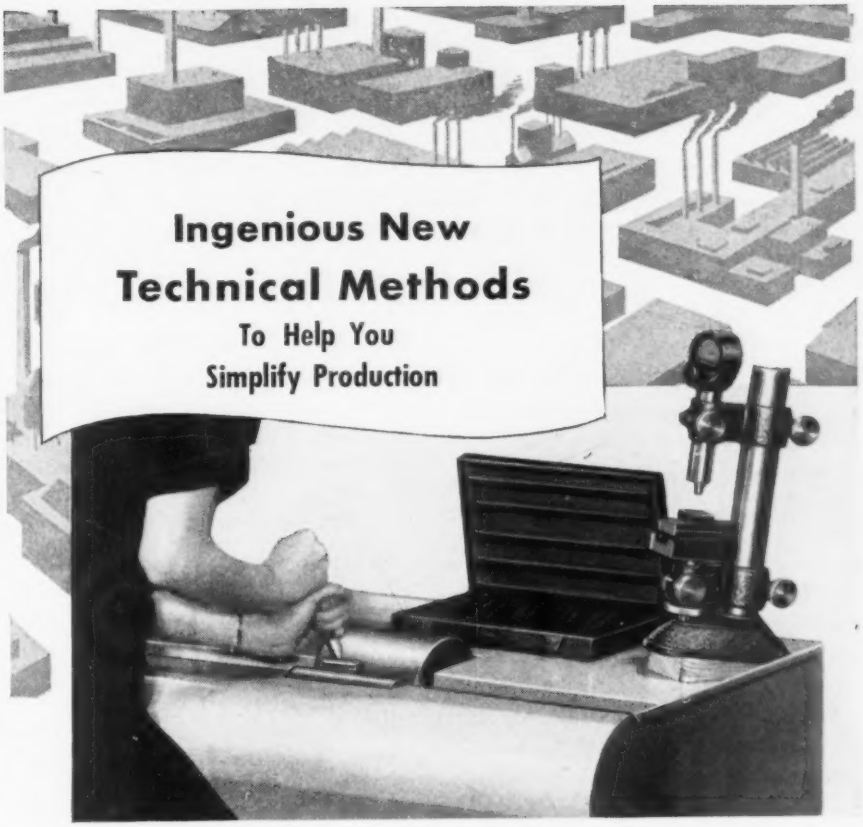
In keeping with the constant endeavor of the Branch to maintain the pace of the rapidly progressing industrial machinery of the nation, the services of several outstanding speakers have been secured.

The following program is to be presented: *Electroplating of Stainless Steel*, John Kreml, Rustless Iron & Steel Co., Baltimore, Md.; *The Economic Aspects of Electropolishing*, W. L. Hults, Schneffel Bros. Co., Newark, N. J.; *An Introduction to Electropolishing, Albert E. Howe*, Federal Tel. & Radio Corp., Newark, N. J.

The educational committee of the Newark Branch under the able leadership of its chairman, *Mr. Zachary Irenas*, is appreciative of the fact that these open meetings have been well attended in the past, and sincerely appreciates the patronage of all men engaged and interested in the science of electroplating and its allied sciences.

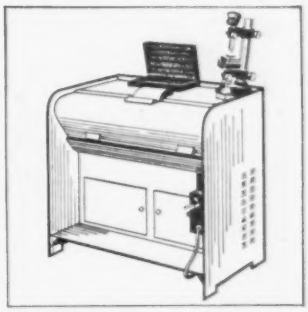
Boston Branch

The annual Educational Meeting and Banquet of the *Boston Branch* of



New Centerless Lapping Machine Gives Precision of Less Than 2 Micro-Inches!

Now it's easy to lap cylindrical pieces—quickly—accurately—without specialized operator skill! The new Size Control Centerless Lapping Machine handles pieces from .010″ to 10″ diameter without costly set-ups.


Centerless Lapping Machine

The operator merely holds piece between lapping rolls with stick. Pressure applied determines quantity of metal removed. Small roll turns piece at slow constant rate. Large roll turns more rapidly to remove minute quantities of metal. Ideal for lapping oversize gages, worn gage plugs to next smaller size, bearings, bushings or shafts. Roll speeds easily changed. Adjustable for tapers.

Ideal also to save time on the job, is chewing gum. The act of chewing aids the workers' concentration; seems to make work go easier. Furthermore, chewing gum may be used even when both hands are busy—increasing worker safety—and reducing work interruptions. That is why many plant owners have made Wrigley's Spearmint Gum available to all.

You can get complete information from
Size Control Company
2500 Washington Blvd., Chicago 12, Ill.

AB-56

the *American Electroplaters' Society* will be held on Saturday, March 22, 1947 at the Statler Hotel, Boston.

The Educational Meeting will begin at 1:30 P. M. and the speakers will be *W. M. Phillips*, *M. M. Beckwith* and *W. H. Jackson*. Subject of each speaker's talk is to be announced at a later date.

Chicago Branch

The December meeting of the *Chicago Branch* of the *American Electroplaters' Society* was held on Friday the 13th at the Atlantic Hotel. The members of the branch indicated their usual intelligence by defying superstition to provide the good turnout. *Mr. Frank Savage*, the supreme president, was in the audience and discussed the problems presented by the prospective changes entailed in drawing up a new constitution for the Society.

Mr. E. F. Hahnfeldt, of the *Mine Safety Appliances Co.*, did an excellent job at almost a moment's notice in presenting the factors involved in manufacturing appliances designed to prevent industrial pulmonary and respiratory hazards. He also touched on the use of protective creams to reduce dermatitis.

He supplemented his remarks with a sound movie, entitled, *The Air We Breathe*, which gave the attending members an excellent idea of the commonplace hazards to which the metal finishing trade is subjected daily.

The question box was well subscribed to.

Baltimore-Washington Branch

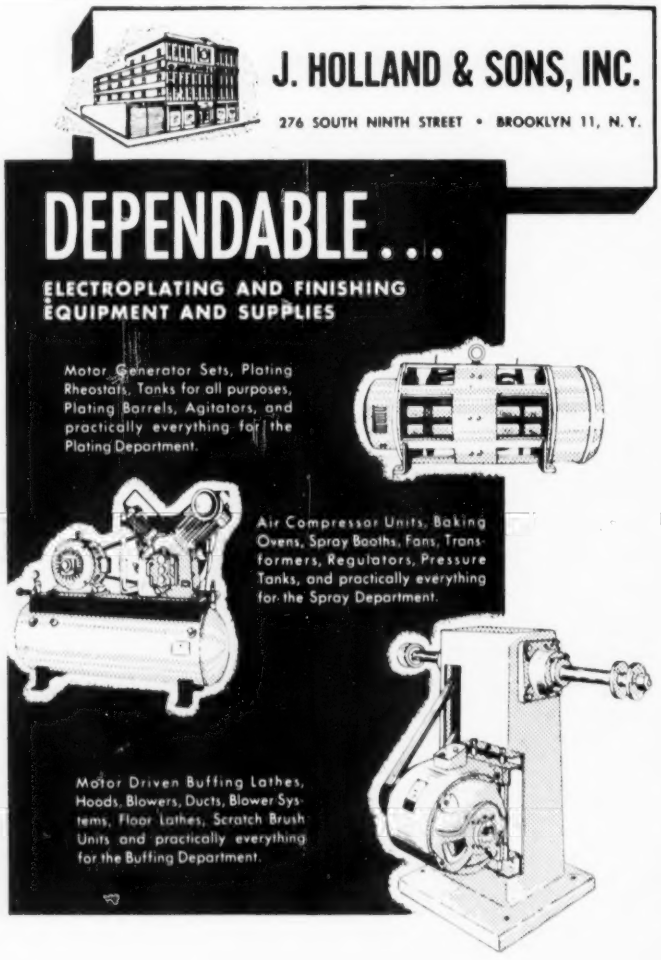
A large number of the *Baltimore-Washington* Branch members of the *American Electroplaters' Society* turned out for the January meeting in Baltimore which consisted of an interesting three hour tour through the *Rustless Iron and Steel Division* of the *American Rolling Mill Co.* Before the members were broken up into groups under special guides, *Stanley P. Watkins*, chief of the Market Development Division of the plant, delivered himself of a short talk in which he described the highlights of the tour. The tour enabled the members to witness such operations as melting, hot rolling of billets and rods, cold rolling of shapes and forms, grinding, wire drawing, annealing, pickling, sodium hydride descaling, hot lead coating and copper plating.

The annual meeting of the Baltimore-Washington Branch was held at the Bureau of Standards in Washington on February 4, 1947. The educational session consisted of two illustrated talks by nationally known speakers. Following this session a buffet snack was served. There was no charge for the buffet snack and the social session.

Los Angeles Branch

The advantages of automatic handling of production as compared to manual handling in plating shops was the subject of an intriguing extemporaneous discussion presented at the January 13 educational session of *Los Angeles Branch* of the *A.E.S.* by *H. J. Moll* of Matawan, N. J., representing the *Hanson Van Winkle Munning Co.*

Mr. Moll was in Southern California in connection with the installation in the *General Electric Company's* plant at Ontario, Calif., of nickel and chrome conveying units. *Gilbert Extale* of the G.E. technical staff, mindful of his duties as chairman of the branch's educational com-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mittee, took advantage of Mr. Moll's presence to prevail upon him to address the first 1947 meeting.

A convincing speaker, with information gleaned from a background of several decades in the industry at his command, Mr. Moll left every plater present convinced that an automatic setup is practically a "must" in the plating field today.

He reviewed the development of automatic conveyors, mentioned the various methods of metal application for which automatics are suitable and practical, and outlined production volumes and shop conditions that would make automatic handling equipment plausible.

"There is a definite need and definite value in the use of automatics in many plants," Mr. Moll said. "In some the need will be more pronounced. The man who wants to get his work done with less loss of time will eventually go in for a system that will move the work through more quickly than by hand.

"Do not expect to be able to whip work in and out with an automatic setup. We insist on two rinses between major treatments when an automatic installation is made. That is elemental. The amount of time you allow for tank to tank transfer is based on the type of work. Two rinses are highly important in bright copper and bright nickel work where control of solution is so important, because two rinses help to keep the solution from being polluted."

Concerning how much production is necessary to make an automatic setup a profitable investment, Mr. Moll said:

"Take all the factors of your overall cost of plant operation, including cost of anodes, electricity, steam, etc. Try to estimate how much nickel, how much copper you have been using on certain types of work and determine whether you have been over- or under-plating. If your total expense runs from $10,000 to $12,000 a year, not including direct labor, it is reasonable to assume that you could save a portion of that expense with automatic handling equipment. Just how much you would save is governed by various factors—how you run your shop, your business, how you handle your men, how you do a lot of things."

At the close of this talk, Mr. Moll

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supplied the explanatory commentary for a series of three films depicting automatic conveyor installations installed for handling propeller blades, typewriter frames and bumper bars in plants in Hartford, Conn., and Cleveland, O.

President *D. N. Eldred* presided at the business session. Guests introduced included *J. P. Paulsen of* Wyandotte Chemical Co., Milwaukee, member of Milwaukee Branch; *H. A. Bennett*, General Electric Co., Ontario; *F. A. Foster*, Latex Dipped Products Co.; *E. W. Meyers*, Atlas Chrome Plating Co.; *H. A. Kirkpatrick*, General Tire & Rubber Co.; *R. W. Nelson*, Grayson Heat Control Co.; *James Beatty*, Harshaw Chemical Co.; *C. R. Sansoni*, Long Beach Plating Co.; *R. A. Mack*, Lynch & Co.; *M. L. Marong*, Sundmark Supply Co.;; and *Ray Rodriquez*, Progressive Plating Co.

Harry Meagher, *Ray Sansoni*, *Ralph Caldwell* and *Lee Piper* were initiated into membership, and the transfer of *Orlando T. Kotts* from Washington to Los Angeles branch was approved.

A letter was read from Executive Secretary *A. K. Graham* complimenting Los Angeles branch on establishing at the Los Angeles Public Library what is probably the first and most complete reference file of the *Monthly Review*, and the annual proceedings. Branch Secretary *Emmette Holman* reported that complete back number files have been delivered to the library for the past dozen years or so from copies supplied by members. He announced that through exchanges with the national office, Mr. Graham had promised to supply back numbers to carry the file of *Reviews* and proceedings back to about 1915. All members agreed that the presence of such a complete file in the library will prove invaluable in future research and reference.

Through an oversight the names of two past-presidents of Los Angeles Branch were omitted from the committee of past-presidents (published in November, 1946, *Metal Finishing*) which was appointed arrangements committee for the branch's 1947 annual educational session. Apologies to *Mr. Williams* and *Mr. Francis*.

During his report on Los Angeles Branch's efforts to obtain the 1948 A.E.S. convention, *Marcus Rynkofs* invited Mr. Moll to advise what the most logical procedure would be for the branch to pursue.

Mr. Moll pointed out that it has been his experience that a great many men who attend conventions "back East" do so with expenses paid by their companies. Many delegates, he said, would possibly feel, that with the greater distance and greater expense involved in traveling to Los Angeles, they might be "cheated" out of their 1948 convention trip. He advised that the branch concentrate much of its effort in convincing eastern members, particularly plant executives, managers, superintendents, that it will not cost much more to come to Los Angeles. He suggested, further, that the local committee stir itself now to obtain all possible information of how groups from eastern points could save expenses by coming in groups by train, plane or bus, by charter railroad car or charter buses, etc. Such information, according to Mr. Moll, is what potential delegates to the convention are anxious to get, as most people back east, he said, would like to come to the west coast, expense and time element not being too excessive.

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WESTERN METAL CONGRESS AND EXPOSITION

More than 40,000 metals scientists, engineers and executives are expected to attend the 5th Western Metal Congress and Exposition which will be held in the two Oakland Civic Auditoriums in the San Francisco-Oakland-Golden Gate area for six days beginning March 22nd, 1947.

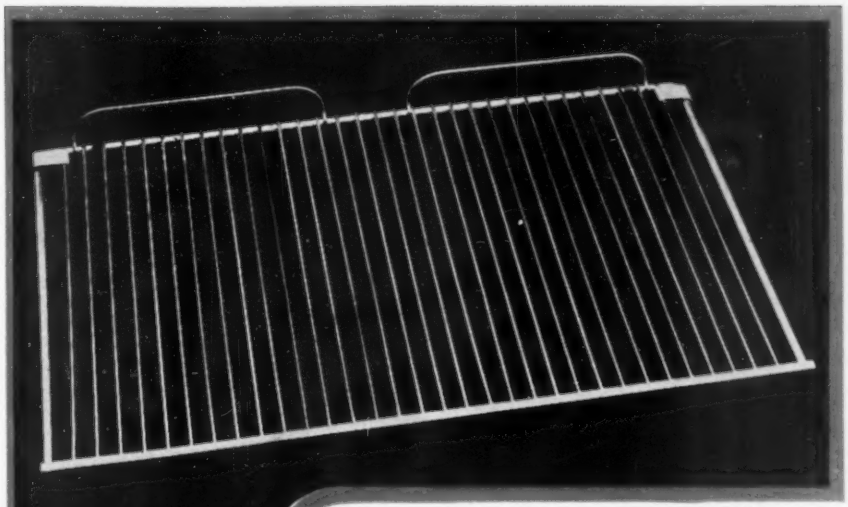
W. H. Eisenman, Managing Director of the Exposition and also national secretary of the American Society for Metals, stated that the estimate is based upon attendance figures of the last previous Western Metals Congress and Exposition held in Los Angeles in 1941.

It was pointed out that further evidence of interest is the fact that more manufacturers of metals industries products are showing in 1947 than ever before in a Western Metal Show. Too, the technical programs already completed show more than 75 technical papers, lecture courses and round table discussions, also a new high for this event.

Sixteen western divisions of technical societies are actively co-operating in program and other activities of the Western Metal Congress and Exposition. The list includes the American Society for Metals, sponsors of the event; the American Chemical Society; the American Foundrymen's Association; the American Industrial Radium and X-Ray Society; the American Institute of Mining and Metallurgical Engineers; the American Institute of Electrical Engineers; the American Society for Testing Materials; the American Society of Tool Engineers, Inc.; the American Welding Society; the Mining Association of California; the Northwest Electric Light and Power Association; the Pacific Coast Electric Association; the Purchasing Agents Association of California, Inc.; Society of Automotive Engineers; Western Oil and Gas Association and the American Petroleum Institute.

All technical sessions and other educational activities of the co-operating societies will be held in the Oakland Civic Auditoriums, the Auditorium Arena and the Auditorium Exhibit Hall, same buildings where the Exposition will take place.

The technical program will open its activities on Monday, March 24th, and



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Metal Finishing February

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will continue through Thursday, March 27th. Members of co-operating societies will attend sessions to be addressed by nationally renowned technical speakers. Daily meetings will begin at 9 A. M. and during the day until 5 P. M. and are expected to attract capacity audiences.

NATIONAL ASSOCIATION OF METAL FINISHERS

The *National Association of Metal Finishers, Inc.*, was recently incorporated under the laws of the State of Michigan with offices located at 2236-39 Dime Building, Detroit, Mich.

For several years, members of the metal finishing industry were cooperating with one another in meeting war-time situations and since the war several meetings were held in Detroit, Chicago, and New York. At the annual dinner of the industry which was held in Pittsburgh on June 18, 1946, an Organization Committee was appointed to prepare by-laws and form a National Association of Metal Finishers. This committee met on several occasions and prepared by-laws after which directors were elected preparatory to incorporating an association. On December 4, 1946 the directors met for their meeting at the Park Central Hotel, New York City, and elected officers.

During the year of 1946 matters of importance were accomplished by the Organization Committee which actually functioned prior to the incorporation of the asociation, and a year-end bulletin was sent to all members. In addition to the year-end bulletin, monthly bulletins were issued and will be issued by the Association as a part of its activities. By-laws were adopted by the Board of Directors as recommended by the Organization Committee. There is only one class of membership in the National Association: that of a local association consisting of five or more members of the industry; each local association having a voice in the functions of the National Association by virtue of its membership.

Raymond M. Shock, the Executive Secretary, is now meeting with local groups of metal finishers throughout the country helping them to organize into local associations, and it is hoped that during the year of 1947 most a metal finishers throughout the cou try will have an interest in this o ganization.

Any local group of metal finishe desiring further information and a cop of the by-laws or bulletins, will recei the same upon writing to the office the secretary, 2236-39 Dime Buildin Detroit 26, Mich.

The first annual meeting of the A sociation is scheduled to be held Detroit on June 22nd to 25th in th Hotel Statler.

News from California

By Fred A. Herr

Featuring an industrial chemica conference and display, the first Pa cific Chemical Exposition will be pr sented in the Civic Auditorium, San Francisco, October 21 to 25, by th California Section, *American Chem cal Society*. Exposition chairman *Paul H. Williams* of the *Shell Develo*

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... and manager is Marcus W. Hi... who has handled the national che... exposition for the Chicago Se... of the A.C.S. for a number of years.

Notice of intention of engaging in business under the following firm names has been filed:

Bu-Vat Polishing & Buffing Co., 223 N. Front St. Burbank, Calif.; Members, George F. Robinson and Norman W. Stiebling.

Inspection & Polishing Co., 6601 San Fernando Road, Glendale. Mike J. Riggio, Carl Gioia and Louis P. Isoglio.

Nubright Polishing Works, 113 West Ann St., Los Angeles. Jerry Acosta and Oresta Maggiora.

Remco Metal Maintenance Contractors, 7033 Madden Ave., Los Angeles. Robert L. Krouse and George J. Meyrowt.

R. R. Sherrill has construction under way at 2535 Cortada Street, El Monte, Calif., on an enameling plant of quonset type construction costing an estimated $10,000.

Ruby Lighting Corp., 1212 S. Olive St., Los Angeles, has completed construction and equipping of a new plating department and will henceforth handle in its own shop the finishing work involved in the production of fluorescent, industrial and office type lighting fixtures. The shop, 60 x 60 feet in area, is equipped with $17,000 worth of plating and polishing machinery. Major items include four polishing lathes and seven solution tanks—a 400 gal. bright nickel, 365-gal. Dupont copper, 200-gal. brass, 200-gal. bronze, 200-gal. cadmium, 200-gal. chrome and 200-gal. copper. Plans for the layout were drawn by *Mike Raskin*, formerly superintendent of plating and polishing for *Ruby Lighting Corp.* Mr. Raskin resigned effective January 1 and has been succeeded as superintendent by *Frank Serot*.

Charles A. Russill, who for many years functioned as an independent job shop operator in Los Angeles under the name of *Russill Plating Works*, has established himself as a plating and processing consultant and shop design engineer, with headquarters at 1710 East Gage Ave., Los An-

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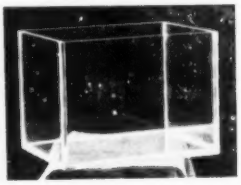
geles. He acts as consultant on general problems of the industry, and designs and supervises the installation of complete new plating departments or additions to existing shops.



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Ray Faeth, formerly shop foreman for *Faith Plating Co.,* Hollywood, has purchased the plant and equipment of the former *Plate and Polish Co.* in the Highland Park District of Los Angeles.

Technical Glass Co., Inc., 2050 East 48th St., Vernon, Calif., has completed construction on a new building to house its newly established plating and polishing department for plating aluminum. The project cost an estimated $70,000, of which $18,000 was for shop equipment. Bright nickel, brass, chrome and dull nickel tanks are included among the facilities, which were installed by the *Sundmark Supply Co.* of Los Angeles under the consultant supervision of *Charles A. Russill.*

D. N. Eldred, president, Los Angeles Branch, *A.E.S.,* has severed connection with *Hallensheid-McDonald Co.,* Los Angeles, where he served as plating department assistant to general superintendent *Don Bedwell.* Eldred is now associated as a partner with his son-in-law, *George M. Kent,* in the *George M. Kent Co.* of Los Angeles, electroplating laboratory. The firm acts as analytical and research consultant for plating shops on solution, machinery and other problems.

Pubco Corp., 2901 E. Slauson Ave., Los Angeles, which has been shut down for some time for reconversion and modernization of plant, was expected to resume production about February 1 on brass valves, faucets and other plumbing fixtures. The revamping of the plating department was completed in mid-January with the installation of a considerable amount of new machinery, including a semi-automatic Harshaw bright nickel setup, generators, filtering apparatus, etc. Pubco Co. is headed by *L. R. Raymond,* with the other offices being filled by his sons, *L. E.* and *W. L. Raymond.* The sons also operate the *California Brass Co.,* 1441 Naud St., Los Angeles.

Chief Products Co., 701 East 59th St., Los Angeles, had installation under way in mid-January on a fully automatic setup engineered and m

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PLATING AND FINISHING

PRINCIPLES OF ELECTROPLATING AND ELECTROFORMING by Wm. Blum and G. B. Hogaboom. 2nd ed.: 1930; 424 pp. Price $4.50. A practical explanation of the principles of electricity, general and analytical chemistry and electrochemistry essential to the electroplater. Processes, materials and plating formulas are given.

PLATING AND FINISHING GUIDEBOOK. 1946. Price $1.00, *payable in advance.* A pocket handbook for the metal finisher. Contains tested formulas of all kinds for the practical man and gives methods for testing coatings and for analyzing plating solutions. Contains sections on organic finishing and on electrical equipment. 1946 is special spiral bound. Ready for distribution October 1st.

MODERN ELECTROPLATING. 1942; 400 pp. Price $6.00 including service and postage. Prepared by various experts and supplied with many references. Provides a comprehensive survey of modern practice. The opening paper describes general principles and methods. Succeeding material deals with the various metal coatings and the solutions from which they are produced.

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METAL FINISHING
11 W. 42nd ST. NEW YORK 18, N. Y.

stalled by *Harold Shepard* of Los Angeles. The 180-foot-long installation, costing $25,000, consists of cycles for cleaning, rinsing, plating in nickel, copper and chrome.

Harry Pierce, Los Angeles plating engineer, returned early in January from a five months' trip to the east and middlewest during which he visited numerous plating shops in New York, Rhode Island, Indiana and the Chicago and Cleveland areas. His purpose was the making of a survey to determine how shop layout and operating methods in the eastern areas compare with prevailing techniques in metal finishing on the West Coast.

Los Angeles Plating Co., 6921 Avalon Blvd., reports the development of a new type of lifting device for attachment to a crane, chain hoist or block and tackle equipment.

Developed in the company's Los Angeles shop, the device resembles an over-sized pair of ice tongs and operates on the same principle. It has a capacity for handling wooden barrels, steel drums and crates weighing up to 1000 pounds. A heavy ring and chain are attached to the top of the unit for convenient hooking to hoisting devices.

Articles of incorporation have been issued to *Mir-O-Col Alloy, Inc.*, Los Angeles, manufacturers and dealers in hard facing alloy metals and precision castings. Associated in the enterprise as directors are *Ben F.* and *F. E. Doke* of West Los Angeles, and *J. W. Dameron*, Huntington Park, Calif.

Part of the office force of the Chas. F. L'Hommedieu & Sons Co., enjoying Christmas dinner last December 24 at the Graemere Hotel in Chicago.

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